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Table 3

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INTRODUCTION

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Volume 9 Number 24 / December 23, 1971

TABLE OF CONTENTS

Subject Categories

Abstracts in the journal are grouped under the following categories:

page:

01 AERODYNAMICS
Includes aerodynamics of bodies, combinations, internal flow in ducts and turbomachinery; wings, rotors, and control surfaces. For applications see: 02 Aircraft and 31 Space Vehicles. For related information see also: 12 Fluid Mechanics; and 33 Thermodynamics and Combustion. **3871**

02 AIRCRAFT
Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc.; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics. **3874**

03 AUXILIARY SYSTEMS
Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines; hydraulic, pneumatic and electrical systems; actuators; and inverters. For related information see also: 09 Electronic Equipment; 22 Nuclear Engineering; and 28 Propulsion Systems. **3875**

04 BIOSCIENCES
Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology. **3876**

05 BIOTECHNOLOGY
Includes life support systems, human engineering; protective clothing and equipment; crew training and evaluation, and piloting. For related information see also: 04 Biosciences. **3880**

06 CHEMISTRY
Includes chemical analysis and identification (e.g., spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants. **3884**

07 COMMUNICATIONS
Includes communications equipment and techniques; noise; radio and communications blackout; modulation telemetry; tracking radar and optical observation; and wave propagation. For basic research see: 23 Physics, General; and 21 Navigation. **3887**

08 COMPUTERS
Includes computer operation and programming; and data processing. For applications, see specific categories. For related information see also: 19 Mathematics. **3891**

09 ELECTRONIC EQUIPMENT
Includes electronic test equipment and maintainability; component parts, e.g., electron tubes, tunnel diodes, transistors; integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications and 21 Navigation. 3897

10 ELECTRONICS
Includes circuit theory; and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see specific Physics categories. 3900

11 FACILITIES, RESEARCH AND SUPPORT
Includes airports; lunar and planetary bases including associated vehicles; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands, shock tubes, and wind tunnels); test ranges; and tracking stations. 3902

12 FLUID MECHANICS
Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. For related information see also: 01 Aerodynamics; and 33 Thermodynamics and Combustion. 3904

13 GEOPHYSICS
Includes aeronomy; upper and lower atmosphere studies; oceanography; cartography; and geodesy. For related information see also: 20 Meteorology; 29 Space Radiation; and 30 Space Sciences. 3909

14 INSTRUMENTATION AND PHOTOGRAPHY
Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gages; recorders; transducers; aerial photography; and telescopes and cameras. 3919

15 MACHINE ELEMENTS AND PROCESSES
Includes bearings, seals, pumps, and other mechanical equipment; lubrication, friction, and wear; manufacturing processes and quality control; reliability; drafting; and materials fabrication, handling, and inspection. 3927

16 MASERS
Includes applications of masers and lasers. For basic research see: 26 Physics, Solid-State. 3930

17 MATERIALS, METALLIC
Includes cermets; corrosion; physical and mechanical properties of materials; metallurgy; and applications as structural materials. For basic research see: 06 Chemistry. For related information see also: 18 Materials, Nonmetallic; and 32 Structural Mechanics. 3933

18 MATERIALS, NONMETALLIC
Includes corrosion; physical and mechanical properties of materials (e.g., plastics); and elastomers, hydraulic fluids, etc. For basic research see: 06 Chemistry. For related information see also: 17 Materials, Metallic; 27 Propellants; and 32 Structural Mechanics. 3942

19 MATHEMATICS
Includes calculation methods and theory; and numerical analysis. For applications see specific categories. For related information see also: 08 Computers. 3947

20 METEOROLOGY
Includes climatology; weather forecasting; and visibility studies. For related information see also: 13 Geophysics; and 30 Space Sciences. 3951

21 NAVIGATION
Includes guidance; autopilots; star and planet tracking; inertial platforms; and air traffic control. For related information see also: 07 Communications. 3954

22 NUCLEAR ENGINEERING
Includes nuclear reactors and nuclear heat sources used for propulsion and auxiliary power. For basic research see: 24 Physics, Atomic, Molecular, and Nuclear. For related Information see also: 03 Auxiliary Systems; and 28 Propulsion Systems. 3955

23 PHYSICS, GENERAL
Includes acoustics, cryogenics, mechanics, and optics. For astrophysics see: 30 Space Sciences. For geophysics and related information see also: 13 Geophysics, 20 Meteorology, and 29 Space Radiation. 3965

24 PHYSICS, ATOMIC, MOLECULAR, AND NUCLEAR
Includes atomic, molecular and nuclear physics. For applications see: 22 Nuclear Engineering. For related information see also: 29 Space Radiation. 3969

25 PHYSICS, PLASMA
Includes magnetohydrodynamics. For applications see: 28 Propulsion Systems. 3984

26 PHYSICS, SOLID-STATE
Includes semiconductor theory; and superconductivity. For applications see: 16 Masers. For related information see also: 10 Electronics. 3996

27 PROPELLANTS
Includes fuels; igniters; and oxidizers. For basic research see: 06 Chemistry; and 33 Thermodynamics and Combustion. For related information see also: 28 Propulsion Systems. 3999

28 PROPULSION SYSTEMS
Includes air breathing, electric, liquid, solid, and magnetohydrodynamic propulsion. For nuclear propulsion see: 22 Nuclear Engineering. For basic research see: 23 Physics, General; and 33 Thermodynamics and Combustion. For applications see: 31 Space Vehicles. For related information see also: 27 Propellants. 4000

29 SPACE RADIATION
Includes cosmic radiation; solar flares; solar radiation; and Van Allen radiation belts. For related information see also: 13 Geophysics, and 24 Physics, Atomic, Molecular, and Nuclear. 4002

30 SPACE SCIENCES
Includes astronomy and astrophysics; cosmology; lunar and planetary flight and exploration; and theoretical analysis of orbits and trajectories. For related information see also: 11 Facilities, Research and Support; and 31 Space Vehicles. 4005

31 SPACE VEHICLES

Includes launch vehicles; manned space capsules; clustered and multistage rockets; satellites; sounding rockets and probes; and operating problems. For basic research see: 30 Space Sciences. For related information see also: 28 Propulsion Systems; and 32 Structural Mechanics. **4016**

32 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; thermal stress; impact phenomena; vibration; flutter; inflatable structures; and structural tests. For related information see also: 17 Materials, Metallic; and 18 Materials, Nonmetallic. **4023**

33 THERMODYNAMICS AND COMBUSTION

Includes ablation, cooling, heating, heat transfer, thermal balance, and other thermal effects; and combustion theory. For related information see also: 12 Fluid Mechanics; and 27 Propellants. **4028**

34 GENERAL

Includes information of a broad nature related to industrial applications and technology, and to basic research; defense aspects; information retrieval; management; law and related legal matters; and legislative hearings and documents. **4033**

SUBJECT INDEX I-1

PERSONAL AUTHOR INDEX I-63

CORPORATE SOURCE INDEX I-71

CONTRACT NUMBER INDEX I-85

REPORT/ACCESSION NUMBER INDEX I-89

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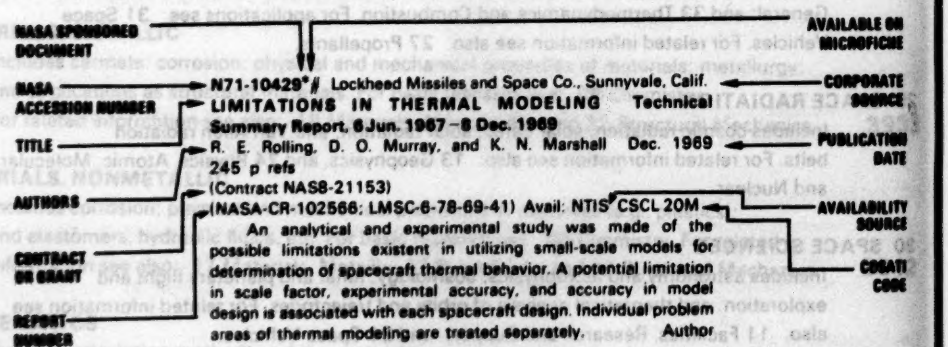
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An analytical and experimental study was made of the possible limitations existent in utilizing small-scale models for determination of spacecraft thermal behavior. A potential limitation in scale factor, experimental accuracy, and accuracy in model design is associated with each spacecraft design. Individual problem areas of thermal modeling are treated separately. Author

VOLUME 9 NUMBER 24 / DECEMBER 23, 1971

Scientific and Technical Aerospace Reports

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01 AERODYNAMICS

Includes aerodynamics of bodies, combinations, internal flow in ducts and turbo machinery; wings, rotors, and control surfaces. For applications see: 02 Aircraft and 31 Space Vehicles. For related information see also: 12 Fluid Mechanics; and 33 Thermodynamics and Combustion.

N71-37693*# Scientific Translation Service, Santa Barbara, Calif.
REVIEW OF TESTING TECHNIQUES FOR TRANSONIC AIRFOILS [CRITIQUE DES TECHNIQUES D'ESSAIS DE PROFILS TRANSSONIQUES]
M. Bazin et al Washington NASA Oct. 1971 49 p refs Transl. into ENGLISH from ONERA preprint of conf. paper Presented to 7th Colloq. on Appl. Aerodyn. Rhone, France, 4-6 Nov. 1970; sponsored by Assoc. Franc. Des Ingr. et Technicien de l'Aeronaut. et de l'Espace
(Contract NASW-2035)
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The testing of airfoils in two-dimensional flow in two types of wind tunnels is discussed. One apparatus makes it possible to carry out tests on large models over a wide range of Reynolds numbers. The study of helicopter blade elements with chords identical to those of rotor blades tested in a similar wind tunnel makes comparisons possible. The systematic study of wall interactions was carried out in the second wind tunnel, which is well adapted for basic research at high Reynolds numbers. Preliminary results indicate corrections which are applicable to test conditions in the latter wind tunnel. Author

N71-37694*# Lockheed-California Co., Van Nuys. Rotary Wing Div.
TRIM, CONTROL, AND STABILITY OF A GYRO-STABILIZED HINGELESS ROTOR AT HIGH ADVANCE RATIO AND LOW ROTOR SPEED
G. A. Watts, R. J. London, and R. J. Snoddy May 1971 312 p refs
(Contract NAS2-5168)
(NASA-CR-114362) Avail: NTIS CSCL 01B

Methods are developed for predicting the behavior of hingeless rotors with stiff blades, at high advance ratios and low rotor speeds. The methods are simple and expository in nature, and are developed for the purposes of: (1) providing insight into the influences of various rotor and control parameters on rotor system behavior, (2) examining the suitability of existing methods which contain more comprehensive analytic descriptions for predicting behavior of hingeless rotors at high advance ratios at low rotor speeds, and (3) providing analysis techniques which are flexible enough to be useful in preliminary design studies. Cyclic angles required to trim rotor hub and swashplate moments are calculated and compared with experimental data. Longitudinal cyclic angles agree well over the advance ratio and rotor speed ranges studied. Lateral cyclic do not agree well, but the discrepancy is systematic, suggesting a lack in the theory. Author

N71-37696# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
AERONYDRODYNAMIC CALCULATIONS OF POORLY STREAMLINED SHIP DESIGNS
S. I. Devnin 3 Mar. 1971 285 p refs Transl. into ENGLISH of the book "Aerogidrodinamicheskii Raschet Plokhoob Tekaemykh Sudovykh Konstruktsii" Leningrad, Izd-vo Sudostroyeniye, 1967 223 p
(AD-727268; FTD-MT-24-304-70) Avail: NTIS CSCL 13/10

The book is intended for a wide circle of engineers and technicians engaged in the study and design of poorly-streamlined structures. It may be used as a textbook for calculating aerodynamic forces acting on a poorly-streamlined surface and submerged ship structures. The experimental and theoretical data on the aerohydrodynamics of poorly-streamlined structures may also be useful in other related fields. Results of experimental and theoretical investigations of the aerohydrodynamics of poorly-streamlined structures are presented in a generalized form. Many experimental data on drag forces and periodic forces acting on various poorly-streamlined structures via gaseous or liquid fluxes are given and methods of approximating drag calculations are developed. GRA

N71-37698# National Research Council of Canada, Ottawa (Ontario). Div. of Mechanical Engineering.
AERODYNAMIC TESTS ON A CENTRIFUGAL FAN IMPELLER MODEL WITH SWEPT-BACK BLADES
H. S. Fowler May 1971 64 p refs
(NRC-12020; ME-237) Avail: NTIS

A low speed centrifugal compressor rig was used to test a 58 1/2 inch diameter model of a fan impeller with highly swept-back vanes. The impeller was run over a range of speeds and throttle settings to explore the whole operating field. The flow was measured at inlet and impeller exit by hot-wire anemometer traverses, and motion pictures of the flow were made using smoke visualisation. The flow through the impeller is described in detail, and is compared with that in other impellers investigated on the same test rig. A comparison is also made with the flow in a geometrically similar impeller tested in a water tunnel. The correspondence between the flows seen in these two experiments is shown to be very close. Author

N71-37697# Douglas Aircraft Co., Inc., Long Beach, Calif.
CALCULATION OF POTENTIAL FLOW ABOUT ARBITRARY THREE DIMENSIONAL LIFTING BODIES Final Report,

Dec. 1969 - Oct. 1970
John L. Hess Oct. 1970 46 p refs
(Contract N00019-70-C-0100)
(AD-727628; MDC-J0971-01) Avail: NTIS CSCL 01/3

The report describes work accomplished during the second phase of a projected three-phase effort to develop a computer program to calculate potential flow about arbitrary three-dimensional lifting bodies. The main task of this phase was programming and checking-out logic that had been developed previously. Evaluation of the method by numerical experimentation has just begun, and the few results obtained so far comprise the body of this report. Simple wings of rectangular planform are considered. Preliminary results indicate that surface pressures are insensitive to wake shape but sensitive to the means of applying the Kutta condition. For some situations there is an anomaly in the surface dipole distribution, which fortunately does not affect the surface pressures. GRA

N71-37598*# Pennsylvania State Univ., University Park.
EXPERIMENTAL STUDY OF ROTOR UNSTEADY AIRLOADS DUE TO BLADE-VORTEX INTERACTION
Raghuveera Padakannaya Washington NASA Nov. 1971 37 p ref
(Grant NGR-39-009-111)
(NASA-CR-1909; PSU-AERSP-71-1) Avail: NTIS CSCL 01A

Measurements of unsteady, rotor-blade airloads and their time derivatives are presented for a rotor blade intersecting a completely rolled-up vortex. These results, taken at the blade spanwise station of 0.9R, 0.85R, and 0.75R, complement measurements previously reported for the 0.95R station in CR-1573. Incremental values in the section lift coefficient as high as 1.17 were obtained at the 0.75R station. Generally, these values decreased with increasing radius. Author

N71-37599*+ National Aeronautics and Space Administration, Washington, D.C.
AERONAUTICAL ENGINEERING: A SPECIAL BIBLIOGRAPHY WITH INDEXES, SUPPLEMENT 9, SEPTEMBER 1971
Sep. 1971 126 p refs
(NASA-SP-7037(09)) Avail: NTIS CSCL 01A

This supplement to Aeronautical Engineering - A Special Bibliography (NASA SP-7037) lists 376 reports, journal articles, and other documents originally announced in August 1971 in Scientific and Technical Aerospace Reports (STAR) or in International Aerospace Abstracts (IAA). The coverage includes documents on the engineering and theoretical aspects of design, construction, evaluation, testing, operation, and performance of aircraft (including aircraft engines) and associated components, equipment, and systems. It also includes research and development in aerodynamics, aeronautics, and ground support equipment for aeronautical vehicles. Each entry in the bibliography consists of a standard bibliographic citation accompanied by an abstract. The listing of the entries is arranged in two major sections, IAA Entries and STAR Entries in that order. The citations and abstracts are reproduced exactly as they appeared originally in IAA or STAR, including the original accession numbers from the respective announcement journals. Three indexes - subject, personal author, and contract number - are included. Author

N71-38627# National Aeronautical Establishment, Ottawa (Ontario). Low Speed Aerodynamics Lab.
LOW SPEED AERODYNAMICS AND THE SCIENCE COUNCIL'S NATIONAL GOALS
R. J. Templin *In* NRC of Can. Quart. Bull. of the Div. of Mech. Eng. and the Natl. Aeron. Estab., 1 Apr. - 30 Jun. 1971 Jun. 1971 p 1-20 refs (See N71-38626 24-30)
Avail: NTIS

02 AIRCRAFT

Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc; and specific types of complete aircraft (e.g., ground effect machines, STOL and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics.

N71-37600*# Techtran Corp., Glen Burnie, Md.
DEPENDENCE OF AIRCRAFT BUFFETING IN THE STRATOSPHERE ON HORIZONTAL TEMPERATURE AND WIND DISTRIBUTION [ZAVISIMOST BOLTANKI SAMOLETOV V STRATOSFERE OT GORIZONTALNOGO RASPREDELENIYA TEMPERATURY I VETRA]
G. S. Buldovskiy Washington NASA Oct. 1971 15 p refs Transl. into ENGLISH from Russian report
(Contract NASw-2037)
(NASA-TT-F-13978) Avail: NTIS CSCL 01B

The relationship between buffeting of aircraft in the stratosphere and horizontal temperature and wind distributions is analyzed on the basis of data collected in previous studies and results of instrument measurements of stratospheric turbulence, done in a special aircraft laboratory at altitudes of 10 to 18-19 km. The task was to determine the critical values of the horizontal parameters that would insure the most successful diagnosis of buffeting. Of all examined parameters considering the horizontal temperature and wind distributions, horizontal wind shears along and across the stream are best for diagnosing stratospheric buffeting. Author

N71-37601*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.
NOISE REDUCTION BY MEANS OF VARIABLE-GEOMETRY INLET GUIDE VANES IN A CASCADE APPARATUS
David Chestnut and Lorenzo R. Clark Washington Oct. 1971 24 p refs
(NASA-TM-X-2392; L-7852) Avail: NTIS CSCL 01C

Noise reduction studies involving variable geometry inlet guide vanes for choking have been made by using a two-sector cascade apparatus with three different inlet configurations: a rotating offset inlet guide vane (IGV), a translating wave IGV, and a stationary uncambered IGV. All three configurations were operated in both the choked and unchoked modes for a range of airflows. The acoustic and aerodynamic performances were found to be dependent on the geometry of the test configurations. Choking in an uncambered IGV resulted in a noise reduction of 49 dB for the fundamental frequency. Choking in the offset IGV and in the wave IGV resulted in noise reductions of 21 dB and 34 dB, respectively. The total-pressure recovery for the uncambered IGV was 0.94 out of 1.00, whereas total-pressure recoveries in the choked mode for the offset IGV and the wave IGV were 0.87 and 0.86, respectively. Author

N71-37602# Air Force Systems Command, Wright-Patterson AFB, Ohio.
FLIGHT DYNAMICS; AIRCRAFT TRAJECTORIES
I. V. Ostoslavskii et al 7 Jun. 1971 663 p refs Transl. into ENGLISH from the book "Dinamika Poleta. Trayektorii Letatelnykh Apparatov" Moscow, Mashgiz., 2d edition, revised and enlarged, 1969 p 5-294 and 299-499
(AD-727474; FTD-HC-23-637-70) Avail: NTIS CSCL 01/2

The book presents methods of calculating flight trajectories of various aircraft and spacecraft. Equations of motion in inertial and noninertial reference systems are derived, along with fundamental laws of flight dynamics and background information on the mathematics of investigation of flight trajectories. Quasi-steady and unsteady motion are examined in relation to additional kinematic couplings, along with general and variational methods of solving problems in flight dynamics. Methods of

calculating elements of trajectories, and takeoff and landing characteristics of aircraft, including ballistic rockets, orbital aircraft, artificial satellites, and spacecraft are given. Methods of calculating the trajectory of ballistic rockets over powered and passive phases is given, along with methods of calculating the trajectory of motion of artificial satellites when injected into orbit. Methods of optixal control of spacecraft are examined briefly. Author (GRA)

N71-37603*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EXPLORATORY WIND-TUNNEL INVESTIGATION OF DEPLOYABLE FLEXIBLE VENTRAL FINS FOR USE AS AN EMERGENCY SPIN-RECOVERY DEVICE
Sanger M. Burk, Jr. Washington Oct. 1971 33 p refs Film Supplement Number L-1103 to this report is available on loan from NASA, Langley Research Center
(NASA-TN-D-6509; L-7877) Avail: NTIS CSCL 01A

Spin-tunnel tests have been conducted on dynamic models of two fighter airplanes to explore the feasibility of using deployable flexible ventral fins as an emergency spin-recovery device. Various fin configurations, deflections, and locations were tested. The results indicated that the fins provided satisfactory spin recoveries for the models tested. Author

N71-37604# Coordinating Research Council, Inc., New York. Aviation, Fuel, Lubricant and Equipment Research Committee.
THE 1969 CRC AVIATION EMISSION-TREATMENT TECHNIQUE EVALUATION
Mar. 1970 58 p ref
(Rept-430) Avail: NTIS

Methods for sampling, handling, and measuring emissions from aircraft gas turbine engines were evaluated. Agreement among three particulate methods in measuring carbonaceous materials was fairly good. Flame ionization detectors were quite satisfactory for measuring hydrocarbon concentrations in the range of 200 to 300 ppm by volume. The Fisher partitioner and the nondispersive infrared aborption (NDIR) analyzer were well suited for measuring carbon monoxide and carbon dioxide. The phenol disulphonic acid method for measuring nitrogen oxides and the NDIR analyzer for measuring nitric oxide performed well. The 3-methyl 2-benzothiazolinone hydrazone hydrochloride method gave fair results when the engine was operated at low rpm and concentrations of oxygenated materials were in the range of 10 ppm. Traverses of the tail pipe plane showed significant variations in emissions among sampling points. The length of sample hydrocarbon sample line was unimportant, but the use of Teflon rather than stainless steel as line material, high line temperature, and high sample flow rate were all judged desirable. Author

N71-37605# Federal Aviation Administration, Washington, D.C.
STOL: THE AGONY AND THE ECSTASY
Ronald W. Pulling Jun. 1971 31 p refs Presented at the Greater Miami Chamber of Com. V/STOL Conf. Workshop, Miami, Fla., Feb. 1971
(WRCN-2; AV71-2) Avail: NTIS

The nature of intercity travel is discussed, and the historical growth of air transportation is reviewed. Some of the significant factors concerning the air transportation penetration into the intercity travel market are presented and discussed. As a result of this penetration, air transportation now accounts for the majority of commercial passenger miles traveled. Commercial air transportation is short-haul oriented with half of all scheduled flights covering distances of 500 miles or less. Commercial air transportation is also oriented toward areas of high population density, with 11 communities accounting for half of all passenger enplanements. The growth in air transportation has resulted in many acute problem areas such as noise, pollution, and traffic congestion. The population increase and the resulting increase in travel demand over the next 10 years will cause a corresponding increase in the severity of these problems. Author

N71-37606# Royal Aircraft Establishment, Farnborough (England).
CATEGORY 2: A SIMULATION STUDY OF APPROACHES AND LANDINGS AT NIGHT
A. D. Brown Jun. 1970 61 p refs
(RAE-TM-Avionics-59(bleu)) Avail: NTIS

The design, execution and preliminary results of a flight simulator experiment to investigate the problems of aircraft operating in Category 2 conditions are described. Both military and airline pilots participated and over 500 approaches were performed. The effects of decision height, contact time, lateral offset, visual sequence and visual segment on the approach success (ratio of landings to approaches) are examined and a curve relating this parameter to visual segment, the predominant factor, is determined. The influence of different visual sequences on pilot performance during the approach and landing is also considered and some observations are made about the crew techniques employed during the experiment which appeared to have certain deficiencies. A full analysis of the flight path performance and pilot comments was omitted. Author

N71-37607# Tippetts-Abbett-McCarthy-Stratton, Washington, D.C.
AIRCRAFT GROUND OPERATIONS SIMULATION
Peter C. Sih Mar. 1971 24 p Presented at 4th Ann. Simulation Symp., Tampa, Fla., 10-12 Mar. 1971
Avail: NTIS

A description is given of an aircraft ground operations simulation program coded in GPSS/360. The physical elements of the airfield are described in terms of GPSS entities and inputted through GPSS matrix savevalues. The aircraft transactions are generated into the model through deterministic flight schedules projected for the simulated target years. The program logic is related to GPSS block actions. Indirect addressing is used extensively to give the program a flexible structure. Supplementary output to standard utilization statistics includes a computer produced movie film. Author

N71-37608# McDonnell Aircraft Corp., St. Louis, Mo.
SURVIVABLE FLIGHT CONTROL SYSTEM. STUDIES, ANALYSES AND APPROACH. SUPPLEMENT FOR HYDRAULIC POWER AND ACTUATION STUDIES Interim Report, Jul. 1969 - May 1971
Gerald E. Amies, Cecil Clark, Charles L. Jones, and M. Sheppard Smyth Wright-Patterson AFB, Ohio AFFDL 29 Oct. 1971 269 p refs
(Contract F33615-69-C-1827)
(AD-727763; AFFDL-TR-71-20-Suppl-3; IR-1) Avail: NTIS CSCL 13/7

The Survivable Flight Control System (SFCS) Program is an advanced development program of which the principal objective is the development and flight test demonstration of an SFCS utilizing Fly-By-Wire and Integrated Actuator Package techniques. The studies and analyses conducted to date have sufficiently defined the system requirements to provide a definition of an approach to the implementation of the SFCS. The results of these studies and the definition of the approach are presented in the basic report. The details of the Control Criteria and Control Law Development studies are presented in report supplements 1 and 2, respectively. The details of the Hydraulic Power and Actuation studies are reported in this supplement 3. Author (GRA)

N71-37609# Mississippi State Univ., State College. Dept. of Aerophysics and Aerospace Engineering.
FEASIBILITY STUDY OF A COMBINED LAMINAR AND TURBULENT BOUNDARY LAYER CONTROL SYSTEM USING DISTRIBUTED SUCTION Final Report, May 1969 - Jan. 1971
Lawrence J. Mertaugh Wright-Patterson AFB, Ohio AFFDL 29 Oct. 1971 83 p refs
(Contract F33615-69-C-1582)
(AD-727767; AASE-71-42; AFFDL-TR-71-47) Avail: NTIS CSCL

20/4

The objective of the investigation was to determine the feasibility of a combined low-drag, high-lift boundary layer control system intended for use in the XV-11A aircraft. The XV-11A is a low-speed aerodynamic research aircraft constructed entirely of glass reinforced plastic. The combined boundary layer control system to provide full chord laminar flow over the wing surfaces in cruise flight and prevent separation of the turbulent boundary layer under conditions of high lift coefficients in the approach configuration will utilize distributed suction over the wing surfaces with the porosity provided by rows of closely spaced suction holes. The evaluation of the laminar system was accomplished on a glove section installed on the wing of a TG-3 glider. GRA

N71-37610# Pennsylvania Univ., Philadelphia. Moore School of Electrical Engineering.
PENNSYLVANIA-PRINCETON ARMY AVIONICS RESEARCH PROGRAM: FORMATION FLIGHT
Kenneth A. Fegley Jun. 1971 214 p refs
(Contract DA-28-043-AMC-02411-E)
(AD-727635; ECOM-02411-21) Avail: NTIS CSCL 01/2

The report summarizes the results of a task whose objective was to determine the problems and functional requirements associated with the non-visual formation flight of helicopters. It also gives the requirements of the stationkeeping system required for non-visual formation flight. Author (GRA)

N71-37611# Army Test and Evaluation Command, Aberdeen Proving Ground, Md.
AUTO PILOT Final Report
10 Jun. 1971 18 p
(AD-727789; MTP-6-3-121) Avail: NTIS CSCL 01/4

Procedures are given for service testing automatic pilots used for control of rotary and fixed wing aircraft. Author (GRA)

N71-37612# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
AERODYNAMICS OF THE TU-134
T. I. Ligum et al 29 Jan. 1971 434 p Transl. into ENGLISH from the monograph "Aerodinamika Samoleta Tu-134" Moscow, 1969 p 1-304
(AD-727196; FTD-MT-24-138-70) Avail: NTIS CSCL 01/3

The book states the practical aerodynamics of the new passenger aircraft Tu-134. Construction and aerodynamic peculiarities are described of the aircraft and power plant with D-30 engines. Basic flight conditions during take-off, climb, horizontal flight and landing stability and maneuverability of the aircraft; special cases in flight; loads acting on the aircraft and its strength are discussed. Author (GRA)

N71-37613# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
TECHNICAL AVIATION HANDBOOK
V. G. Aleksandrov et al 7 Apr. 1971 798 p Transl. into ENGLISH from the monograph "Aviatsionnyi Tekhnicheskii Spravochnik" Moscow, 1969 p 1-495
(AD-727195; FTD-MT-24-126-70) Avail: NTIS CSCL 01/2

The material in this handbook is generalized, systematized and set forth with respect to the following questions: practical aerodynamics; technical operation and maintenance of aircraft (helicopter) airframes, their systems, gas-turbine and piston engines, oxygen and high-altitude equipment, instrument-flying navigation devices; electronic equipment; lubricants employed in the operation and repair of the aviation equipment; wear of components, subassemblies and mechanisms, repair and routine maintenance operations; maintenance of the components and systems of the aircraft, gas-turbine and piston engines, inspection and checking operations, anticorrosive treatments; aviation materials being employed, fuels, lubricants and working fluids; article defects and strength of materials. This handbook is intended for flight and technical-engineering personnel of all branches of aviation, the aviation industry, scientific institutions, students of the higher and intermediate aviation educational institutions. Author (GRA)

N71-37614# Stevens Inst. of Tech., Hoboken, N.J. Davidson Lab.
IMPACT LOADS ON WARPED PLANING SURFACES LANDING ON SMOOTH AND ROUGH WATER Final Report
John A. Mercier Mar. 1971 53 p refs
(Contract N00600-69-C-1072)
(AD-727753; SIT-DL-71-1514) Avail: NTIS CSCL 01/3

The impact of planing surfaces on waves is analyzed according to an extension of the theory for smooth-water impacts in a way that takes account of the influence of wave kinematics. Impacts of the type incurred by seaplanes, in which the weight of the craft is sustained by wing lift, are studied. Data for planing, which is a special case of impact, are used to obtain the needed relationship between virtual mass and hull geometry. Impact tests with two models having different amounts of warp, or longitudinal variation of deadrise, are compared with theoretical calculations. Observations are made concerning the influence of trim, deadrise, beam loading, glide path, warp rate and waves on the initial stages of the impact, when the vertical velocity is practically uniform, on the basis of the derived differential equation of motion. Author (GRA)

N71-37615# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
VARIABLE SWEEP. CHAPTERS 1-5
S. Yu. Skripnichenko 25 Feb. 1971 79 p Transl. into ENGLISH from the book "Izmenyayemaya Strelovidnost" Moscow, Izd-vo Min. Oborony SSSR, 1969 p 1-72
(AD-727210; FTD-MT-24-264-70) Avail: NTIS CSCL 01/3

Contents: the aerodynamics of variable-sweep wing; the stability and control of variable-sweep wing; variety of operating conditions - a feature of variable-sweep; flight at low altitudes; short take-off and landing of variable-sweep wing. Author (GRA)

N71-37616# McDonnell Aircraft Corp., St. Louis, Mo.
SURVIVABLE FLIGHT CONTROL SYSTEM. STUDIES, ANALYSES AND APPROACH. SUPPLEMENT FOR CONTROL CRITERIA STUDIES Interim Report, Jul. 1969 - May 1971
Robert L. Kisslinger and Michael J. Wendl Wright-Patterson AFB, Ohio AFFDL May 1971 201 p refs See also Supplement 3; AD-727763
(Contract F33615-69-C-1827)
(AD-727762; AFFDL-TR-71-20-Suppl-1; ir-1) Avail: NTIS CSCL 01/3

The Survival Flight Control System (SFCS) Program is an advanced development program of which the principal objective is the development and flight test demonstration of an SFCS utilizing fly-by-wire and integrated actuator package techniques. The studies and analyses conducted to date have sufficiently defined the system requirements to provide a definition of an approach to the implementation of the SFCS. The results of these studies and the definition of the approach are presented in the basic report. Details of the Control Law Development, and Hydraulic Power Actuation studies are presented in report supplements 2 and 3, respectively. The results of the Control Criteria studies are presented in this supplement. Author (GRA)

N71-37617# School of Aerospace Medicine, Brooks AFB, Tex.
PILOTS, TAKE HEED OF BIRDS
V. S. Lavrik et al 1971 101 p refs Transl. into ENGLISH of the book "Letchik, Vnimaniye-Pitsy!" Moscow, 1970
(AD-727881; SAM-TT-R-1093-0771) Avail: NTIS CSCL 01/2

Contents: analysis of statistical data on cases of collision of aircraft with birds; analysis of physical discoveries, observed when aircraft and birds collide, and basic types of damage to aviation equipment; measures for preventing collisions of aircraft with birds. GRA

N71-37618# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ROCKET CARRYING AVIATION (SELECTED CHAPTERS)
A. N. Ponomarev 2 Mar. 1971 281 p refs Transl. into ENGLISH from the book "Raketsonosnaya Aviatsiya" Moscow, Izd-vo Ministerstva, 1964 p 1-23; 99-340
(AD-727860; FTD-MT-24-258-70) Avail: NTIS CSCL 19/7

Contents: aircraft; air navigation and takeoff and landing aids; flight support at high altitudes and equipment for rescuing the pilot (crew member) in an emergency situation. GRA

N71-37619# Naval Air Development Center, Johnsville, Pa. Aero structures Dept.
STRUCTURAL INTEGRITY INVESTIGATION OF REWORKED S-2 CORRUGATED WING SKIN PANELS
H. Lysted and Louis Berman 1 Apr. 1971 40 p refs
(AD-726009; NADC-ST-7107) Avail: NTIS CSCL 01/3

Laboratory fatigue tests were performed on reworked S-2 corrugated wing skin panels to determine the effect on the structural integrity of skin material removal due to corrosion damage. Reworking of the S-2 aircraft corrugated wing skin panels, as performed by the Naval Air Rework Facilities, to remove corrosion damaged material, does not adversely effect the structural integrity of the panels. Author (GRA)

N71-37620# Operations Research, Inc., Silver Spring, Md.
A GUIDE TO ASSESS THE OPERATIONAL IMPLICATIONS OF NEW SHIP DESIGN CONCEPTS
Ernest L. Holmboe, Joseph M. Sheehan, and Allen D. Evans 11 Jun. 1971 139 p refs
(Contract N00014-70-C-0426)
(AD-726003; ORI-TR-667) Avail: NTIS CSCL 01/3

The study is an exploratory effort to identify a fundamentally sound approach that will expose the potential operational utility of new ship design concepts in the 1985 plus time frame and to develop that approach into a rational methodology. The scope of the present study only includes development of an evaluation methodology; it does not include an actual evaluation of the new ships. The focus is on concepts that offer unique operational characteristics relative to the conventional displacement ship, e.g., hydrofoil, hovercraft, captured air bubble, catamaran, and semisubmerged ships. This interim report summarizes the study elements under development at this time. Author (GRA)

N71-37621# Royal Aircraft Establishment, Farnborough (England).
THE EFFECT OF DAZZLE ON ELECTRONIC DISPLAY [EINFLUSS DER BLENDUNG AUF DAS ERKENNEN ELEKTRONISCHER ANZEIGEN IN KANZELN MODERNER HOCHLEISTUNGSFLUGZEUGE: KURZFASSUNG]
P. Jeineki Mar. 1971 27 p Transl. into ENGLISH of Ger. Federal Min. of Defence report T-908-I-203
(RAE-Lib-Trans-1545; T-908-I-203) Avail: NTIS

The performance of pilots in testing electronic head-up and head-down display systems is discussed. Measurements were made of the dazzle effect in the cockpit of high performance aircraft during daylight conditions. The measuring criteria include length of display from subject, color used on symbols, and intensity of light. Results indicate red to be particularly suitable for recognition of display symbols and that the head-down display is favored over the head-up display. E.H.W.

03 AUXILIARY SYSTEMS

Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines; hydraulic, pneumatic and electrical systems; actuators; and inverters. For related information see also: 09 Electronic Equipment; 22 Nuclear Engineering; and 28 Propulsion Systems.

N71-37622*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Guidance and Control Div.
EFFECTS OF STORAGE TEMPERATURES ON SILICON SOLAR CELL CONTACTS
Paul Berman and R. K. Yasui 15 Oct. 1971 42 p refs
(Contract NAS7-100)
(NASA-CR-123185; JPL-TR-32-1541) Avail: NTIS CSCL 10A

Solar cells having various contact systems and configurations were investigated to determine the effect of storage temperature and duration on cell electrical and mechanical characteristics. Cells having n diffused into p-base silicon, p diffused into n-base silicon, and p diffused into n-base lithium containing silicon were studied. Contact systems of silver-titanium, silver-titanium with solder coating, silver-titanium with palladium, and electroless nickel were investigated. The results showed that electrical and mechanical degradations previously observed in high humidity, high temperature environments were the result of the combined environment and not due to the temperature component alone. Author

N71-37623*# Eagle-Picher Co., Joplin, Mo. Couples Dept.
STUDY OF PROCESS VARIABLES ASSOCIATED WITH MANUFACTURING HERMETICALLY-SEALED NICKEL-CADMIUM CELLS Quarterly Report, 28 Nov. 1970 - 28 Feb. 1971
Lee Miller, Donald J. Doan, and Earl S. Carr Sep. 1971 155 p refs
(Contract NAS8-21559)
(NASA-CR-122289; QR-4) Avail: NTIS CSCL 10A

Process variables associated with the positive and negative plaque impregnation/ polarization process were studied. The experimental data resulting from the implementation of fractional factorial design experiments were analyzed by means of a linear multiple regression analysis technique. This analysis permitted the selection of preferred levels for certain process variables to achieve desirable impregnated plaque characteristics. Major conclusions drawn from the results of these investigations are presented. Author

N71-37624# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PROSPECTS FOR THE APPLICATION OF HIGH TEMPERATURE FUEL CELLS
I. L. Kolbenev et al 28 Jan. 1971 11 p refs Transl. into ENGLISH from Energomashinostr. (Moscow), no. 4, 1970 p 30-31
(AD-727497; FTD-HT-23-884-70) Avail: NTIS CSCL 10/2

The work is concerned with prospects for application of high-temperature fuel cells (HTFC) as power sources. Results of analytical research on determination of cell parameters as functions of working process temperature and fuel type are given. Author (GRA)

N71-37625# Eagle-Picher Co., Joplin, Mo. Couples Dept.
A LOW TEMPERATURE MINIATURE AUTOMATICALLY ACTIVATED MAGNESIUM BATTERY Final Report, Apr. 1969 - Apr. 1971
E. P. Broglio Wright-Patterson AFB, Ohio AFAPL Apr. 1971 121 p
(Contract F33615-69-C-1760)
(AD-727066; AFAPL-TR-71-25) Avail: NTIS CSCL 10/3

The report covers the development of a magnesium automatically-activated battery. The battery is intended to supply power for expendable electronic devices. The specification highlights include a 10 minute yield at 30 watts from a 10 cubic inch battery in -40 to +125F ambients and at 40,000 ft. altitude. The goals and the approach in a two phase program are presented. Included are the results of both evaluations conducted under the contract. In the preliminary design phase, the battery evolved from a 100% mercury oxide concept to a 50-50 manganese-dioxide-mercury oxide unit. The operation of this gas generator activated battery is explained and the development program is outlined. Author (GRA)

N71-37626# Howard (P. L.) Associates, Inc., Centreville, Md.
DEVELOPMENT OF A HIGH POWER DENSITY SILVER OXIDE-ZINC LIQUID ELECTRODE BIPOLAR PRIMARY BATTERY Final Report
Paul L. Howard 30 Jun. 1971 33 p refs
(Contract N00019-70-C-0204)
(AD-727126) Avail: NTIS CSCL 10/3

The report covers the development of a pasted AgO primary battery electrode which is solid until the time it is wet down and then it becomes a mushy electrode which performs equal to or better than the present sintered, charged and assembled AgO electrode. Similarly the zinc electrode behaves the same way. This new development simplifies the processing and assembly of duplex primary battery electrode and gives a higher power density than conventional batteries. Prototype two cell units were made and successfully tested. Author (GRA)

N71-37627# General Electric Co., Lynn, Mass. Direct Conversion Business Section.
AC POWER SYSTEM EVALUATION VARIABLE FREQUENCY INPUT: CONSTANT FREQUENCY OUTPUT Final Report, 1 Feb. 1970 - 1 Feb. 1971
R. Torkildsen, D. W. Craft, and R. C. Jones Feb. 1971 126 p
(Contract N00019-70-C-0323)
(AD-727748; Doc-71-DE-1) Avail: NTIS CSCL 10/2

Efficient, light-weight power conditioning equipment was investigated in the area of AC to AC transformation, where AC of a variable frequency is to be transformed efficiently into AC of a fixed frequency at a significant power level. This task, which follows an earlier contract where a bridge chopper technique was developed for DC to AC power conversion, had as its objective the development of a system utilizing the capacitance effect of a storage battery in addition to its storage capability to permit the conversion from AC over output in the event of a source failure. The effort was conducted in two phases. The first phase was an investigation of the methods which could be used to control the flow of power from the source AC generator to a storage battery link and from the battery to the waveform generator and to the output circuit. The second phase was to select a method which would represent an optimum of the approaches considered and then breadboard and evaluate the components in a system configuration. Author (GRA)

N71-37628# TRW Systems Group, Redondo Beach, Calif.
POWER SUPPLY PP-6418( )/U Final Report, Jun. - Dec. 1970
D. L. Cronin Jun. 1971 54 p
(Contract DAAB07-70-C-0245)
(AD-727839; ECOM-0245-F) Avail: NTIS CSCL 10/2

The power supply, designated power supply PP-6418( )/U, furnishes 0-100 amperes DC over an output voltage range of 24 to 32V DC from a nominal 120/208V AC, 50, 60, 400, or 1600 Hz, three phase power source and can be used for battery charging from 5A to 100A and floating of batteries across the DC output at end of charge. (Modified constant potential charging mode with variable current limiting.) The high reliability power supply design incorporates state-of-the-art switch modulation power processing technology to overcome size, weight, efficiency and performance limits typically obtained in conventional design. Efficiency, weight and size achieved are approximately 90 percent, 56.9 pounds and 1.22 cu. ft., respectively. Line voltage is directly rectified to produce a DC voltage which is further processed to achieve the desired nominal voltage level of 28V DC. The heart of the power processing system is a very efficient silicon controlled rectifier (SCR) series capacitor type inverter, arranged in a two-phase configuration, which embraces special features of power modulation and active filtering. Static and dynamic regulation, one order of magnitude better than realized by present state of the art equipment, is obtained through a novel two-loop method, effecting a form of frequency modulation control with individual inverter pulse repetition rates of approximately 14 kHz under nominal line and load conditions. Remote sensing, over/under-voltage and overload protection are provided. Author (GRA)

N71-37629# Air Force Systems Command, Wright-Patterson AFB, Ohio.
DEVELOPMENT OF AN EXPERIMENTAL CRYOTURBOGENERATOR
V. V. Dombrovskii et al 11 Jun. 1971 20 p refs Transl. into ENGLISH from the publ. "Turbo- i Gidrogeneratory Bolshoy Moshchnosti i Perspektivy Ikh Razvitiya" Leningrad, Izd. Nauka, 1969 p 44-45
(AD-727901; FTD-HT-23-124-71) Avail: NTIS CSCL 10/2

At the present time, the most promising way of raising the unit power and economy of turbogenerators is to use windings made of superconductors and pure metals cooled to cryogenic temperatures - 30 degrees K and lower. Apparently, the best solution is to use superconductors for the excitation windings and pure aluminum for the armature windings; other versions are also possible, for example, the use of pure metal for the excitation winding as well. Leading foreign electrical engineering companies have carried out intense research on the application of low temperatures to electrical machines; the first experimental samples of electrical cryomachines have already been created and investigated. In this paper are given certain results of the development of an experimental cryoturbogenerator intended for laboratory research. Author (GRA)

N71-37630*# National Aeronautics and Space Administration, Washington, D.C.
SPACECRAFT SOLAR CELL ARRAYS
May 1971 54 p refs
(NASA-SP-8074) Avail: NTIS CSCL 10A

The significant experience and knowledge accumulated in operational programs for an effective design of spacecraft solar cells, are reviewed. The discussion includes current state of the art design practices, increased reliability in the end product, and greater efficiency in the design effort for conventional missions. Author

04 BIOSCIENCES

Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology.

N71-37631# National Inst. of Radiological Sciences, Chiba (Japan).
RADIOACTIVITY SURVEY DATA IN JAPAN
Aug. 1970 15 p
(NIRS-RSD-28) Avail: AEC Depository Libraries

The data include external exposure rates due to natural radiation in the Tohoku district of Japan during 1969 and 1970; dietary data including the Sr-90 and Cs-137 contents of rice, a standard diet, and the total diet in Japan during 1968 and 1969; and the monthly deposition of Sr-90 and Cs-137 in precipitation in Japan during 1969 and 1970. The cumulative deposition for this period is also given. All data are presented in tabular form. NSA

N71-37632*# Cornell Univ., Ithaca, N.Y. Center for Radiophysics and Space Research.
ULTRAVIOLET SELECTION PRESSURE ON THE EARLIEST ORGANISMS
Carl Sagan May 1971 14 p refs
(Contract NGR-33-010-101)
(NASA-CR-123193; CRSR-448) Avail: NTIS CSCL 06F

An examination of the probable photochemistry of the primitive reducing atmosphere of the earth reveals a window, approximately bounded at 2400 A. The solar ultraviolet flux in this 2600 A window, delivered to unprotected organisms at the surface, corresponds to a contemporary mean lethal dose in < or ~ 0.3 seconds. Extreme selection pressure for ultraviolet protection must have come into being. In addition to the early

evolution of pyrimidine dimer ligases, catalase and peroxidase reduction mechanisms, and photoreactivation. It is suggested that two evolutionary paths developed. In one, heterotrophs lived below the oceanic thermocline and are suggested as perhaps the ancestors of the prokaryotes. In the other, organisms living near the oceanic surface surrounded themselves with ultraviolet absorbing layers of purines and pyrimidines. The resulting organisms have dimensions of tens to hundreds of microns and are suggested to be the ancestors of the eukaryotes. Subsequent specialization of this initially inert shielding, into ribosomal RNA, may have occurred. Author

N71-37633*# Cornell Univ., Ithaca, N.Y. Lab. for Planetary Studies.
ON ULTRAVIOLET LIGHT AND THE ORIGIN OF RIBOSOMES
Carl Sagan and Paul Shapshak May 1971 13 p refs
(Grant NGR-33-010-101)
(NASA-CR-123164; CRSR-446) Avail: NTIS CSCL 06F

The complex chemical changes in nucleo-peptides giving rise to contemporary ribosomes are discussed. Possible mechanisms used for the synthesis of these interactions are discussed along with the possible effects of UV light on the complex evolutionary processes involved in the interactions. E.H.W.

N71-37634*# Louisiana State Univ., New Orleans. Dept. of Otorhinolaryngology.
A STUDY OF THE RELATIONSHIPS BETWEEN THE MECHANICAL RESPONSE OF THE TYMPANIC MEMBRANE AND THE ELECTROPHYSIOLOGICAL INDICATORS OF HEARING IN THE BULLFROG (RANA CATESBEIANA)
Deborah A. Mejaeu-Chargois and Jean McDaniel Whitehead 2 Nov. 1971 49 p refs
(Grant NGL-19-001-024)
(NASA-CR-123162) Avail: NTIS CSCL 06C

The visible mechanical response of the tympanic membrane of the bullfrog and what relation it has to the indicators of hearing determined electrophysiologically was studied. Seven subjects were presented with pure tones of varying frequency and intensity while the tympanic membrane was viewed under stereoscopic illumination. Thresholds of visible mechanical response were recorded for each frequency tested. Graphic data revealed a nonlinear relation between frequency and intensity with two definite areas of sensitive hearing. The areas of sensitive hearing corresponded to the best frequencies revealed electrophysiologically. The range of frequencies eliciting mechanical response corresponds to the range of frequencies eliciting electrophysiological response. The size of the membrane determines the amount of intensity necessary to elicit a visible mechanical response. Author

N71-37635*# National Aeronautics and Space Administration, Washington, D.C.
CONTINUOUS MEASUREMENT OF THE ACTION OF POTASSIUM AND SODIUM WITHIN THE INTERSTICE OF MUSCLE STRIA DURING PHYSICAL EXERCISE [MESURE CONTINUE DE L'ACTIVITE DU POTASSIUM ET DU SODIUM DANS L'INTERSTICE DU MUSCLE STRIE DURANT L'EXERCICE MUSCULAIRE]
G. Gerbert et al. Oct. 1971 3 p Transl. into ENGLISH from J. Physiol. (Paris), v. 62, no. 53, 1970 p 380
(NASA-TT-F-13966) Avail: NTIS CSCL 06P

The levels of potassium and sodium in the interstitial fluid of muscles were continuously measured, at rest and during exercise, with ion specific glass microelectrodes. The values found and their known vasodilating effects correlate well with the functional hyperemia observed in muscles during exercise. Author

N71-37636*# Scientific Translation Service, Santa Barbara, Calif.
ON ELECTROKINETIC PHENOMENA AT BIOLOGICAL SURFACES WITH SPECIAL CONSIDERATION OF THE RED BLOOD CELLS [UBER ELEKTROKINETISCHE ERSCHEINUNGEN AN BIOLOGISCHEN GRENZFLAECHEN UNTER BESONDERER BERUECKSICHTIGUNG DER ROTEN BLUTZELLEN]
A. Verga Washington NASA Oct. 1971 20 p refs Transl. into ENGLISH from Wetter-Boden-Mensch. v. 4, no. 12, May 1971 p 1-16
(Contract NASW-2038)
(NASA-TT-F-14007) Avail: NTIS CSCL 06A

The electrical charge and field strength at the cell membrane of human erythrocytes are determined and their importance for modern diagnostics stressed. It was found that each red blood cell carries about 8000 elementary charges at the membrane surface. Author

N71-37637*# Techtran Corp., Glen Burnie, Md.
POPULATION GENETICS OF THE RED CELL ACID PHOSPHATASE
G. Radam et al Washington NASA Oct. 1971 7 p refs Transl. into ENGLISH from Humangenetik (West Germany), no. 2, 1966 p 378-380
(Contract NASW-2037)
(NASA-TT-F-13969) Avail: NTIS CSCL 06P

Gene frequencies of red cell acid phosphatase have been determined in a random sample of 1186 adults of the environs of Berlin, as well as in a sample of 66 individuals from North Vietnam. The probability of exoneration, with use of the erythrocyte phosphatase test in a paternity lawsuit, amounts to 24.6% for the German population. Author

N71-37638*# Translation Consultants, Ltd., Arlington, Va.
WATER-SALT METABOLISM DURING SPACE FLIGHT [VODNO-SOLEVOY OBMEN PRI KOSMICHESKIKH POLETAKH]
I. S. Beleikhovskiy Washington NASA Oct. 1971 15 p refs Transl. into ENGLISH from Biosstronaut., 23th Intern. Astronaut. Congr. (London), v. 4, 1970 p 101-113
(Contract NASw-2038)
(NASA-TT-F-14028) Avail: NTIS CSCL 06P

The weight loss observed during the space flight of astronauts cannot be explained by tissue decomposition, because after the flight there was no increase of urinary nitrogen. During a water loading test on the following day after landing, astronauts V. M. Komarov and B. B. Yegorov excreted water at a slower rate than in control observations. This suggests that the weight loss was due to expelling of liquid in weightlessness. For the investigation of water and salt metabolism during space flight it is necessary to have adequate methods for blood microanalysis and for the determination of actively circulating blood volume. A method is described for the determination of sugar, chlorine, urea, cholesterol and lipid phosphorus in a single sample of 0.1 ml blood, stored in dry form on filter paper, and a technique is proposed to study the blood volume and velocity of blood mixing based on the capacity of hemoglobin for specific binding of carbon dioxide. Author

N71-37639*# Translation Consultants, Ltd., Arlington, Va.
STATUS OF WATER-SALT METABOLISM UNDER SPACE FLIGHT CONDITIONS [SOSTOYANIYE VODNO-SOLEVOGO OBMENA V USLOVIYAH KOSMICHESKOGO POLETA]
I. S. Beleikhovskiy et al Washington NASA Oct. 1971 18 p Transl. into ENGLISH from Akad. Nauk USSR (Moscow), 1971 22 p
(Contract NASw-2038)
(NASA-TT-F-14029) Avail: NTIS CSCL 06P

The body weight loss manifested by Soviet and American astronauts after space flights was investigated. Tests confirmed that tissue decomposition was not the cause of this loss but that losses of liquid and salt through weightlessness brought this about. Author

N71-37640*# San Jose State Coll., Calif. Biological Sciences Dept.
INTERMEDIATE ELECTRON TRANSPORT IN PORPHYRIDIUM: EPR STUDIES
Ellen C. Weaver 1971 9 p refs Presented at the 2nd Intern. Congr. on Photosynthesis, Stresa, Italy, 24-29 Jun. 1971
(Grant NGR-05-046-008)
(NASA-CR-123158) Avail: NTIS CSCL 06A

The photosynthetic electron transport between plant reaction centers are observed by light induced EPR signals. The signal's influence on oxidized p700 are observed; from these observations the reactions between the two systems are inferred. The effects of temperature on such reactions are also discussed. Results from the experiments compare favorably with fluorescence yield measurements. E.H.W.

N71-37641*# Louisiana State Univ., Baton Rouge. Dept. of Electrical Engineering.
A MODEL OF THE PHYSIOLOGICAL SYSTEMS OF VEGETATION
Murli Manohar Viswanathan and Paul M. Julich 1971 22 p refs
(Grant NGR-19-001-024)
(NASA-CR-123169; bull-105) Avail: NTIS CSCL 06C

The feasibility of developing a mathematical model capable of explaining the metabolic working process of a plant as a whole us discussed. The processes include photosynthetic, transpiration, C02 diffusion from the atmosphere to chloroplasts, respijation, transpiration, and stomatal. A method by which these processes maybe controlled is also discussed. E.H.W.

N71-37642*# Public Health Service, Phoenix, Ariz. Applied Microbiology and Planetary Quarantine Section.
SERVICES PROVIDED IN SUPPORT OF THE PLANETARY QUARANTINE REQUIREMENTS Quarterly Progress Report, Jul. - Sep. 1971
Martin S. Favero Sep. 1971 20 p refs
(NASA Order W-13062)
(NASA-CR-122844; QPR-35) Avail: NTIS CSCL 06M

Tables and graphs are presented on the effects of microbal contamination of the electronic piece parts in spacecraft. Data are also included for heat resistance testing of the sieve processed AO hanger vacuum cleaner dust; heat resistance testing of Bacillus sp.; and microbiological studies of the Apollo 15 command module. Results were compared with Apollo 11, 12, 13, and 14 modules. Slight microbal variations were observed amoung the modules. E.H.W.

N71-37643*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MARINER MARS 1971 POST-LAUNCH ANALYSIS OF COMPLIANCE WITH PLANETARY QUARANTINE REQUIREMENTS
Alan R. Hoffman and Ralph J. Reichert 16 Aug. 1971 29 p Sponsored by NASA
(NASA-CR-122845) Avail: NTIS CSCL 06K

An updated analysis on the probability of Mariner Mars 1971 Project contaminating Mars with viable terrestrial microorganisms is presented. The analysis includes the revisions warranted by encapsulation microbiological assays, launch and early post launch events. The updated analysis indicates that with the modified Mission A strategy, including aiming point biasing and orbit periapsis altitude selection, the planetary quarantine constraints for the Mariner Mars 1971 Mission are being satisfied. Author

N71-37644*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
BLOCK UP AND DOWN DESIGN FOR ESTIMATING SENSORY THRESHOLDS
Don H. Card and Michio Aoyagi Oct. 1971 31 p refs
(NASA-TM-X-62090) Avail: NTIS CSCL 05J

The block up-down, two-alternative, forced-choice experimental design for the estimation of sensory thresholds is investigated. A mathematical model of the procedure is developed and recursion formulas are derived for bias and mean-square error of the sample average estimator. Block designs for various step sizes are compared on the basis of two measures of efficiency: (1) efficiency expressed as the reciprocal of the mean-square error of the average estimator per trial and (2) relative efficiency of the average estimator with respect to the probit estimator based on fixed stimulus levels. Author

N71-37645# Los Alamos Scientific Lab., N.Mex.
EYEBURN THRESHOLDS
John Zinn, Ronald C. Hyer, and Charles A. Forest May 1971 9 p refs
(Contract W-7405-eng-36)
(LA-4651) Avail: NTIS

A series of calculations that relate to identification of minimum threshold conditions for production of retinal burns, such as may occur in the imaging of intense light sources; e.g., lasers and nuclear explosions, are reported. Consider the combined effects of optical absorption and thermal conduction in the retinal tissue for image diameters ranging from 1 to 1000 microns. Threshold energy dose levels are computed, based on the assumption that a retinal burn is the result of a temporary temperature excursion of at least 20 C. The results are compared with laboratory measurements of eyeburn threshold levels in primates and rabbits. A set of computed safe retinal dosage curves is presented, based on the assumption that temperature excursions of 5 C or less are not harmful, (5 C being the expected maximum temperature rise produced in an image of the sun). Author (NSA)

N71-37646# Texas Univ., Austin. Lab. of Radiation Biology.
[PROGRESS REPORT ON PHYSICOCHEMICAL STUDIES OF RADIATION EFFECTS IN CELLS]
E. L. Powers May 1971 11 p refs
(Contract AT(40-1)-3408)
(ORO-3408-10) Avail: NTIS

Studies were continued on water content, oxygen, and photoreversal of germicidal ultraviolet effects on spores. Studies on sensitivity of bacterial spores to heat and X radiation showed that when spores were irradiated in the wet anoxic state that maximizes survival after heat treatment, a biphasic survival curve was obtained. It was found that renaturation by fast cooling changes the conformation of the sensitive component only slightly as measured by radiosensitivity, whereas slow cooling results in two configurations, neither of which resembles the original unheated spore geometry. Author (NSA)

N71-37647# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
PACIFIC NORTHWEST LABORATORY ANNUAL REPORT FOR 1970 TO THE USAEC DIVISION OF BIOLOGY AND MEDICINE. VOLUME 2: PHYSICAL SCIENCES. PART 2: RADIOLOGICAL SCIENCES
J. M. Nielson Mar. 1971 97 p refs
(Contract AT(45-1)-1830)
(BNWL-1551-Vol-2-Pt-2) Avail: NTIS

Papers are presented on radiation physics, chemistry, and medicine. Topics discussed include radiation instrumentation, radioactive composition of the atmosphere and oceans, radionuclides in man, and radioactive fallout. K.P.D.

N71-37648# Oak Ridge National Lab., Tenn.
EXAMPLES OF ECOLOGICAL TRANSFER MATRICES
Robert V. O'Neill Jun. 1971 26 p refs
(Contract W-7405-eng-26)
(ORNL-IBP-71-3) Avail: NTIS

Available literature has been surveyed for data to quantify linear, constant-coefficient models of ecological systems. In all, 23 papers were located with a total of 66 transfer matrices. The

ecological systems range from 2 to 17 state variables and cover a wide spectrum of terrestrial and aquatic systems. The matrices are documented for their heuristic value and to provide a preliminary data base for the development and testing of new mathematical analysis techniques. Author

N71-37649# Air Force Systems Command, Wright-Patterson AFB, Ohio.
RADIATION HAZARDS OF SPACE FLIGHTS
19 Mar. 1971 8 p refs Transl. into ENGLISH of pamphlet for the 1970 Exhibit of Achievements of the Natl. Econ. (USSR), 1970 p 2-4
(AD-727245; FTD-HT-23-78-71) Avail: NTIS CSCL 06/18

The article discusses cosmic radiation, different types of radiation and its effect on biological organisms, various tests carried out in flights, radiation received by the cosmonauts, and some of the protective measures. Author (GRA)

N71-37650# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CYCLE OF WORK AND REST FOR COSMONAUTS
B. S. Alyakrinskii 12 Mar. 1971 7 p refs Transl. into ENGLISH of pamphlet for the 1970 Exhibition of Achievements of the National Economy (USSR) p 1-2
(AD-727226; FTD-HT-23-81-71) Avail: NTIS CSCL 06/5

The pamphlet gives a brief outline of the basic factors affecting the diurnal work/rest cycle for spacecraft crews. It is written in popular style for distribution at the 1970 Exhibition of Achievements of the National Economy. Author (GRA)

N71-37651# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
MONOMETHYLHYDRAZINE EFFECT ON BLOOD, IN VITRO
Harold F. Leahy Dec. 1970 18 p refs Presented at 1st Ann. Conf. on Environ. Toxicol., Fairborn, Ohio, 9-11 Sep. 1970; sponsored by SysteMed Corp. *Its* Paper No. 24
(AD-727528; AMRL-TR-70-102) Avail: NTIS CSCL 06/20

A study was conducted, first to confirm previous work with respect to the identification of the hemoglobin compound formed and species difference in methemoglobin level; second, to determine the involvement of oxygen in the reaction; and third, to identify the major breakdown products of MMH in the in vitro system. Author (GRA)

N71-37652# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
HUMAN EXPOSURE TO EEL CONCENTRATIONS OF MONOMETHYLYHDRAZINE
James D. MacEwen, James Theodore, and Edmond H. Vernot Dec. 1970 10 p refs Presented at 1st Ann. Conf. on Environ. Toxicol., Fairborn, Ohio, 9-11 Sep. 1970; Sponsored by Systemed Corp. *Its* Paper No. 23
(AD-727527; AMRL-TR-70-102) Avail: NTIS CSCL 06/20

A group of human volunteers were exposed to the tentative 90 ppm-minute dose of monomethylhydrazine to determine its suitability for actual use. The exposures were conducted by inserting the subject's head into a Rochester Chamber. The MMH concentrations, which were continuously monitored, were established and stabilized in the chamber and then the subject inserted his head for 10 minutes and his sensations were recorded. For comparative purposes, 2 concentrations of ammonia vapors (50 and 30 ppm) were established in the chamber and the same volunteers made similar observations of oder and irritability. The results of the study demonstrate that the tentative 90 ppm MMH 10 minute emergency exposure limit has an adequate safety factor and did not produce bronchospasm or severe lacrimation. It is recommended that the tentative status of this EEL be removed. GRA

N71-37653# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
GAS CHROMATOGRAPHIC RETENTION DATA
William H. Tolliver, Sr., Sheldon A. Landon, and Anthony A. Thomas Dec. 1970 14 p refs Presented at 1st Ann. Conf. on Environ. Toxicol., Fairborn, Ohio, 9-11 Sep. 1970; sponsored by SysteMed Corp. *Its* Paper No. 19
(AD-727523; AMRL-TR-70-102) Avail: NTIS CSCL 07/4

Gas chromatography (GC) is one of the more useful instrumental methods of analysis in biochemical research for toxicology and pollution studies. This paper discusses an approach to the solution of the problem of reproducibility of retention data. The main purpose is to present a method of reporting gas chromatographic data that is reproducible, meaningful and relatively easy to generate. In addition, two questions will be discussed: (1) What is retention data and (2) What value does it have for the toxicologist. The application of the Kovats Retention Index System to toxicology is discussed. The system relies on the basic approach of analytical chemistry of bracketing an unknown with two standards. The Kovats system has the advantage that it can describe on its scale any compound that can be chromatographed. This general index system recommends itself for use in the expression of retention data in toxicological studies. GRA

N71-37654*# Kentucky Univ., Lexington. Wenner-Gren Aeronautical Research Lab.
STRUCTURAL DEVELOPMENT OF BONE IN THE RAT UNDER EARTH GRAVITY, SIMULATED WEIGHTLESSNESS, HYPERGRAVITY AND MECHANICAL VIBRATION
John Paul Jankovich Washington NASA Oct. 1971 155 p refs
(Grant NGL-18-001-003)
(NASA-CR-1823) Avail: NTIS CSCL 06C

Biophysical properties of bone in the femur and tibia of the rat were measured during eight months of exposure to earth gravity, hypergravities of 1.5, 2.0 and 2.8g, produced by continuous centrifugation, and during four months of exposure to mechanical vibration. Plaster cast immobilization of one hind leg was applied to simulate the hypodynamic state of weightlessness. Animals were successively sacrificed to determine the physical, mechanical and physiological parameters of bone. Mineralization was traced by periodic administration of tetracycline. Radiographic densitometry was employed in vivo and in vitro to follow up bone development. At earth gravity normal aging takes place while physical dimensions, density, rigidity, micro-hardness, sound conductivity, and ash content of bone increase. Bone porosity and calcium content remain constant. Rats under hypergravity have smaller rates of growth than rats at 1g. The differences are due entirely to differences in fatty tissue. Bone development as a function of age was found to be unaffected. Chronic vibration increases stiffness and microhardness of bone. In vibrated bone the active fronts of mineralization disappear and deposition becomes dispersed across the diaphysis. Immobilization significantly decreases bone density, ash and calcium content; immobilized bone becomes less porous and more brittle than normal. In the hypergravity range investigated, no significant and systematic changes were found; however, simulation of weightlessness was found to produce pronounced atrophy of bone. Author

N71-37655*# General Electric Co., Philadelphia, Pa.
A STUDY OF ASEPTIC MAINTENANCE BY PRESSURIZATION
D. J. Chester, J. T. Negrey, D. L. McMenemin, and J. J. Shull Washington NASA Nov. 1971 65 p
(Contract NAS1-10061)
(NASA-CR-1910) Avail: NTIS CSCL 06M

Studies were performed to determine the pressure differentials required to prevent the passage of airborne microorganisms through holes in membranes acting as barriers to preserve asepsis. Analytical and experimental results showed that the effectiveness of the pressure differential is a function of the particle density, velocity and diameter. At a given particle density, it was observed that a differential pressure of .06 inches of water was sufficient to prevent passage of particles of up to 10 microns in diameter through holes of diameters up to 3000

microns when particle velocities were due only to gravitational forces. At greater particle velocities the dependence on hole diameter became more noticable. A pressure differential .05 inches of water above the stagnation pressure was discovered to be sufficient to maintain asepsis with holes up to 1000 microns in diameter when particle velocities were less than 15 mph. Holes 20, 200, and 1000 microns in diameter were found to be associated with critical velocities of 30, 26 and 15 mph respectively, above which a marked increase in pressure differential was required to prevent penetration. Effects of temporary pressure loss were also evaluated to determine minimum penetration time. A data summary combines the results of this contract with those of the previous studies. Author

N71-37656 National Lending Library for Science and Technology, Boston Spa (England).
THE PROBLEM OF CREATIVENESS OF RESEARCH-WORKERS
R. Robin Dec. 1970 24 p Transl. into ENGLISH from Kodak-Pathe Bur. of Res. into Appl. Human Sci. Publ., Dec. 1970 15 p
(NLL-Trans-746-801-(9022.401)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

A psychotechnical analysis of the creativeness of research personnel, based on personal interviews, is presented. Tasks, working conditions, and personal qualities are discussed as well as the organizational structure, interpersonal relationships, motivations, and the possibility of failure. The dynamics of the research worker including his reactions to situations, materials, temptation, and risk and his aggressiveness and self-image are also considered. J.M.

N71-37745# Medical and Applied Research System, Inc., Rockville, Md.
THE IMPACT OF AUTOMATION UPON HEALTH DELIVERY SYSTEMS IN THE 1970'S
Neil M. Trowe *In* Inform. Process. Assoc. of Israel Proc. of the Natl. Conf. on Data Process. 1970 p E35-E45 (See N71-37742 24-08)
Avail: NTIS HC $6.00/MF $0.95

N71-37818# Joint Publications Research Service, Washington, D.C.
PRESENT STATE AND FUTURE DEVELOPMENT OF HYPERBARIC OXYGENATION
I. V. Sultanov et al *In its* Develop. in Pressure Chamber Technol. 1 Oct. 1971 p 13-21 (See N71-37815 24-11)
Avail: NTIS

N71-37885# Joint Publications Research Service, Washington, D.C.
SYSTEMS ENGINEERING ASPECT OF ENGINEERING PSYCHOLOGY
D. I. Agaykin *In its* Man in Control Systems 1 Oct. 1971 p 1-2 ref (See N71-37864 24-05)
Avail: NTIS

N71-38644# Joint Publications Research Service, Washington, D.C.
STUDY OF TRACE CONTAMINANTS IN MAN-EXHALED AIR
Yu. G. Nefjodov et al *In its* 22d Intern. Astronautical Congr. 28 Oct. 1971 p 6-10 (See N71-38642 24-30)
Avail: NTIS

05 BIOTECHNOLOGY

Includes life support systems, human engineering; protective clothing and equipment; crew training and evaluation, and piloting. For related information see also: 04 Biosciences.

N71-37667*# Analytical Research Labs., Inc., Monrovia, Calif.
A STUDY OF PHYSIOCHEMICAL FACTORS AFFECTING CHARCOAL ADSORPTION OF CONTAMINANTS IN MANNED SPACE CRAFT ATMOSPHERE Final Report
C. L. Deuel Aug. 1971 144 p refs
(Contract NAS9-11049)
(NASA-CR-115202; Rept-1666-F) Avail: NTIS CSCL 06K

Data generated from a study of analytical stripping procedures for compounds adsorbed on charcoal, along with time and temperature variations in thermal-vacuum stripping are presented. Comparison of six storage materials and/or containers for maintaining contaminant free charcoal is made. There is a listing of more than twenty compounds apparently formed by catalytic action of charcoal on a prepared gas mixture. Gas evolution studies from mass spectrometric examination of heated charcoal is summarized in a series of figures. A rather extensive program of development of adsorption isotherms with mathematical modeling, along with derivation of the mathematics involved is also listed. The results from application of predicted adsorption capacity of a prepared mixture indicates successful application of the mathematical modeling. There is also a brief study on the efficiency of adsorption-desorption of compounds on two charcoals of different origins as well as on 5A molecular sieve. Author

N71-37668*# Massachusetts Inst. of Tech., Cambridge. Dept. of Nutrition and Food Science.
ANALYSIS OF STORAGE STABILITY OF INTERMEDIATE MOISTURE FOODS Final Report, 15 May 1970 - 15 Jul. 1971
Theodore P. Labuza 15 Jul. 1971 173 p refs
(Contract NAS9-10668)
(NASA-CR-115194) Avail: NTIS CSCL 06H

The preparation of intermediate moisture foods (IMF) is examined in connection with selecting a food for astronauts without the need of rehydration. Storage studies of at least 3 months duration of several IMF items including a meat, vegetable, and fruit type product were carried out. Tables are presented for different foods and different methods of manufacture. Through control of the method of preparation these foods can be made shelf stable to microbiological decay. It was shown that, because of sorption hysteresis, a food of similar solids composition, similar water activity, but vastly different water content could be prepared by following a desorption versus an adsorption process. Packaging requirements were also determined. E.M.C.

N71-37669*# Techtran Corp., Glen Burnie, Md.
ON THE CORRELATION OF VISUAL-MOTOR REACTION TIME AND LIGHT SENSITIVITY [O SOOTNOSHENII VREMENI ZRITEL'NO-DVIGATEL'NYKH REAKTSIV I SVETOVOY CHUVSTVITEL'NOSTI]
T. N. Ushakova Washington NASA Oct. 1971 17 p refs Transl. into ENGLISH from Vop. Psikhologii (USSR), no. 1, 1967 p 97-106
(Contract NASW-2037)
(NASA-TT-F-13995) Avail: NTIS CSCL 05E

Comparison of data concerning motor reaction time and visual sensation thresholds (at the horizontal meridian of the retina) indicates the existence of a functional relationship between these indices. An increase in thresholds corresponds, as a rule, to the prolongation of related periods of visual-motor reactions. Visual acuity is based psychologically on the resolution capacity of the eye, which depends in turn on the density of light-sensitive nerve endings. The hypothesis of the action of the force well is indirectly verified by this fact. Author

N71-37660*# Bellcomm, Inc., Washington, D.C.
INTRODUCTION TO THE PHYSICS OF WEIGHTLESSNESS
G. T. Orrok and S. Shapiro 27 Sep. 1971 61 p refs
(Contract NASw-417)
(NASA-CR-123161; TM-71-1011-6) Avail: NTIS CSCL 22A

The motion of free objects within or near spacecraft in circular orbit is discussed. The forces-gravity and drag- and typical motions are described with emphasis on assumptions and limitations of the treatment. Solutions are given for particle trajectories. E.H.W.

N71-37661*# Bellcomm, Inc., Washington, D.C.
THE ORIGIN OF LIGHT FLASHES OBSERVED BY APOLLO ASTRONAUTS
M. Liwshitz 30 Sep. 1971 52 p refs
(Contract NASw-417)
(NASA-CR-123173; Tm-71-2015-5) Avail: NTIS CSCL 06P

Results of laboratory exposure of human subjects to several types of particulate radiation and to energetic X-rays suggest that the bulk of reported luminous phenomena are radiation-induced phosphenes, that is, sensations of light due to direct interaction of ionizing radiation with nervous tissue in the retina. Author

N71-37662*# General Electric Co., Houston, Tex. Apollo Systems Dept.
FOOD SYSTEM FOR SPACE SHUTTLE PROGRAM Final Report
30 Apr. 1971 49 p
(Contract NAS9-11037)
(NASA-CR-115207; TIR-720-S-0008) Avail: NTIS CSCL 06H

The design of the space shuttle food system in the crew compartment is considered. The seven main sections of the food system are delineated as menu, measurement, storage, preparation, serving, consumption, and cleanup disposal. The performance and design criteria for each of these sections are presented. J.A.M.

N71-37663# Los Alamos Scientific Lab., N.Mex.
FILTER EFFICIENCY VERSUS PARTICLE SIZE AND VELOCITY
Ronald G. Stafford and Harry J. Ettinger Mar. 1971 7 p refs
(Contract W-7405-eng-36)
(LA-4650) Avail: NTIS

Several commercial filter media were evaluated for efficiency as a function of particle size and velocity. Particle size and velocity producing minimum efficiency are different for each media and are well below single fiber theoretical predictions. Experimental efficiencies were generally higher than theoretical total mat efficiencies. Author (NSA)

N71-37664# Joint Publications Research Service, Washington, D.C.
MAN IN CONTROL SYSTEMS
1 Oct. 1971 44 p refs Transl. into ENGLISH from Prib. Sist. Upr. (Moscow), no. 10, 1970 p 9-21
(JPRS-54171) Avail: NTIS

CONTENTS:

1. SYSTEMS ENGINEERING ASPECT OF ENGINEERING PSYCHOLOGY D. I. Ageykin p 1-2 ref (See N71-37665 24-04)

2. SIMULATION OF COMPLEX CONTROL SYSTEMS WITH AN OPERATOR V. A. Sharov p 3-9 refs (See N71-37666 24-05)

3. PROCEDURE FOR ANALYSIS OF DATA REPRESENTATION SYSTEMS FOR THE MAN-OPERATOR CONTROLLING A COMPLEX AUTOMATED OBJECT A. G. Chachko p 10-20 refs (See N71-37667 24-05)

4. MATRIX METHOD OF REPRESENTING OPERATIVE DATA Yu. A. Ivashkin p 21-25 refs (See N71-37668 24-05)

5. METHOD AND DEVICE FOR THREE-DIMENSIONAL REPRESENTATION OF INFORMATION G. P. Katys et al p 26-30 refs (See N71-37669 24-05)

6. ENGINEERING-PSYCHOPHYSIOLOGICAL ESTIMATE OF LINEAR GAS-DISCHARGE DISPLAYS AS A MEANS OF COMPLEX DATA REPRESENTATION V. V. Pechnikov p 31-36 refs (See N71-37670 24-05)

7. PROBLEM OF EVALUATING THE ACTIVITY OF A GROUP OF OSCILLATORS IN CONTROL SYSTEMS Yu. A. Golant p 37-43 (See N71-37671 24-05)

N71-37665# Joint Publications Research Service, Washington, D.C.
SYSTEMS ENGINEERING ASPECT OF ENGINEERING PSYCHOLOGY c04
D. I. Ageykin *In its* Man in Control Systems 1 Oct. 1971 p 1-2 ref (See N71-37664 24-05)
Avail: NTIS

A general discussion of engineering psychology as a component part of systems engineering is presented. Engineering psychology is considered to be significantly lagging behind systems engineering practices, and the cause is attributed to poor training. Three areas of development are suggested: (1) simulation procedures for joint operation of man and technical devices in which the model of human activity considers heuristics, and transition form one conceptual model to another during the training process; (2) a method of analysis and synthesis of data representation systems which involve the operator and process control algorithms; and (3) new methods for representing large volumes of information for the operator, insuring maximum use of the human characteristics. F.O.S.

N71-37666# Joint Publications Research Service, Washington, D.C.
SIMULATION OF COMPLEX CONTROL SYSTEMS WITH AN OPERATOR
V. A. Sharov *In its* Man in Control Systems 1 Oct. 1971 p 3-9 refs (See N71-37664 24-05)
Avail: NTIS

Algorithmic simulation of ergatic systems (SASES) is studied for designing control systems with an operator. The requirements of the SASES language are considered to be: (1) it must describe the behavior algorithms of the operator, and those for the operation of the computer. (2) It must be a machine oriented language. (3) It must provide the possibility of describing the system structure and the characteristics of its links. It is concluded that programming and simulation of the operator activity permit consideration of the individual and not the average characteristics of man. It results in optimizing algorithms and programs with respect to given criteria. F.O.S.

N71-37667# Joint Publications Research Service, Washington, D.C.
PROCEDURE FOR ANALYSIS OF DATA REPRESENTATION SYSTEMS FOR THE MAN-OPERATOR CONTROLLING A COMPLEX AUTOMATED OBJECT
A. G. Chachko *In its* Man in Control Systems 1 Oct. 1971 p 10-20 refs (See N71-37664 24-05)
Avail: NTIS

Procedures for applying logical and mathematical schemes to the analysis of representation systems of automated control systems are presented. Topics discussed include: analysis sequence, structure of model, characteristics of input flow, and calculation of the representation systems. Results of applying the procedure to the representation systems of a 200 megawatt boiler-turbine unit are presented. F.O.S.

N71-37668# Joint Publications Research Service, Washington, D.C.
MATRIX METHOD OF REPRESENTING OPERATIVE DATA c08
Yu. A. Ivashkin *In its* Man in Control Systems 1 Oct. 1971 p 21-25 refs (See N71-37664 24-05)

Avail: NTIS

The possibility of developing a standardized method for compact and systematized representation of a set of functionally related parameters is investigated. Starting with a n-element set of variables described by a system of static equations, the matrix representation is derived of the dynamic situation in the space of monitored attributes which is visually realized in the form of a set of luminous points on a cathode ray tube. F.O.S.

N71-37669# Joint Publications Research Service, Washington, D.C.

METHOD AND DEVICE FOR THREE-DIMENSIONAL REPRESENTATION OF INFORMATION c08

G. P. Katys et al *In its* Man in Control Systems 1 Oct. 1971 p 26-30 refs (See N71-37664 24-05)

Avail: NTIS

A method is proposed for three-dimensional reproduction of information based on using the phenomenon of photochromism. Colored sections, corresponding to incoming information are obtained using a set of transparent photochrome information panels. Combining the photochrome information panels in the observation zone presents a visual display of the information. Automatic feeding of the photochrome information panels to the observation zone synchronized with the data recording and erasing processes is realized by the electromechanical part of the device. During visual analysis of the images, the observation zone is illuminated by neutral light. The operation is controlled by an auxiliary computer insuring decoding of the coordinates and the corresponding commutations. F.O.S.

N71-37670# Joint Publications Research Service, Washington, D.C.

ENGINEERING-PSYCHOPHYSIOLOGICAL ESTIMATE OF LINEAR GAS-DISCHARGE DISPLAYS AS A MEANS OF COMPLEX DATA REPRESENTATION

V. V. Pechnikov *In its* Man in Control Systems 1 Oct. 1971 p 31-36 refs (See N71-37664 24-05)

Avail: NTIS

The application of linear gas-discharge displays on control panels and mnemonic systems for data representation was studied in a group of four linear gas-discharge displays with vertical scale, and two double pointer-type indicators with circular scales. The results of psychophysiological studies of reading precision by the linear gas-discharge displays, and engineering-psychophysiological studies of complex means of representing information on a linear gas-discharge display are discusseb. F.O.S.

N71-37671# Joint Publications Research Service, Washington, D.C.

PROBLEM OF EVALUATING THE ACTIVITY OF A GROUP OF OSCILLATORS IN CONTROL SYSTEMS c08

Yu. A. Golant *In its* Man in Control Systems 1 Oct. 1971 p 37-43 (See N71-37664 24-05)

Avail: NTIS

Group dynamics was studied as a basis for evaluating group activity as a function for restricting the interaction of the members in a group. The results of calculating the group structures by the criterion of relative rank of the group leader are discussed. It is concluded, that the relations obtained indicate that with an increase in the value of the relative rank of the leader, the group as a whole performs the assignment in shorter times, and with fewer errors. F.O.S.

N71-37672# Infoton, Inc., Burlington, Mass.

MATHEMATICS OF SYNCODERS Final Report, 1 Dec. 1969 - 30 Nov. 1970

Dilip K. Matur and Ernest G. Henrichon, Jr. Mar. 1971 83 p refs

(Contract F33615-70-C-1196)

(AD-727087; AMRL-TR-70-138) Avail: NTIS CSCL 08/4

The goal of the research was twofold; first, to establish a mathematical foundation for the description of the operation of the syncoder and networks of syncoders; and second, to identify classes of problems which can be best programmed for solutions on a Syncoder Computer. No new specialized mathematics has been developed in this report. Suggestions of existing branches of mathematics were made, where appropriate, for describing certain processing capabilities of syncoder nets. Consideration was given to the processing capabilities of small and topologically deterministic nets only. Information coding in terms of average frequency of signal pulse trains was examined in detail. Networks whose state reflects the sequence of excitation at their inputs were designed. The concept of sequence detection was developed into first-arrival-time gating networks and networks capable of pattern recognition. Both deterministic and stochastic processing is suggested as the direction for the concentration of future research. Author (GRA)

N71-37673# Illinois Univ., Urbana. Biological Computer Lab.

NEURAL MODELLING METHODOLOGY, TECHNIQUES AND A MULTILINEAR MODEL FOR INFORMATION PROCESSING

Michael G. Wilkins 29 Oct. 1971 177 p refs

(Contract OE-C-1-7-071213-4557; Grant AF-AFOSR-1865-70)

(AD-727770; UILU-ENG-70-297; AFOSR-71-2151TR; TR-19) Avail: NTIS CSCL 06/4

The physiology, membrane electrophysiology and biophysics relevant to single neuron models are examined in detail, and the foundations of the structure-function concept examined.

Author (GRA)

N71-37674# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.

ACQUISITION SLANT RANGES FOR TARGETS Final Report

Herschel C. Self 29 Oct. 1971 30 p refs Presented at Remote Control Technol. Symp., Santa Monica, Calif., 20 May 1970

(AD-727772; AMRL-TR-70-96) Avail: NTIS CSCL 05/8

The report summarizes several studies on display systems having to do with target detection or recognition and all having implications for target acquisition slant range. It considers size, contrast and resolution as important. It is noted that large, clearly-resolved targets are often missed or are detected only at close ranges, even at helicopter speeds. A requirement of 15-20 TV lines on target and 12-20 minutes of arc angular subtense on displays is discussed for unbriefed targets. This means that only narrow ground swaths can be displayed. Percentages of unbriefed targets detected as well as acquisition ranges are noted in relation to the maximum permited by the displayed size and resolution of the target images. Author (GRA)

N71-37675# Manned Systems Sciences, Inc., Northridge, Calif.

STUDY OF CREW PERFORMANCE MEASUREMENT FOR HIGH-PERFORMANCE AIRCRAFT WEAPON SYSTEM TRAINING: AIR-TO AIR INTERCEPT Final Report

Donald Vreuls and Richard W. Obermayer Feb. 1971 233 p refs

(Contract N61339-70-C-0089)

(AD-727739; NAVTRADEVCEN-70-C-0089-1) Avail: NTIS CSCL 05/9

A study was undertaken to develop performance measurement and methods for deriving performance measurement for F-4J air-to-air intercept training in an envisioned adaptive and automated training environment. It was found that a combined analytic-empirical test method was mandatory for defining measurement for adaptive training. The functional relationships between measures, the tasks and the adaptive variables must be known in order to properly design an adaptive logic. Single measure feedback control for adaptive training of multi-dimensional tasks did not appear feasible. A simplified method to handle multi-dimensional measurement based on tolerance bands was suggested. Using this approach a set of candidate

measures for the pilot, for the Radar Intercept Officer, and for the crew composed of both were analytically derived. Further tests of the measures were recommended. It was concluded from a measurement viewpoint that an automated weapon system trainer was feasible provided that empirical tests of the measurement relationships to the task and adaptive variables are conducted. All measurement algorithms must be tested throughout the entire operating range because idiosyncratic behavior of the trainee cannot be predicted by analysis.
Author (GRA)

N71-37676# Philco-Ford Corp., Palo Alto, Calif. Western Development Labs.
OPERATOR PERFORMANCE AND PANEL LAYOUT FOR DISCONTINUOUS TASKS Final Report, 1 Jan. 1969 - 1 May 1970
R. A. Goldbeck, K. A. Wright, and R. L. Fowler Wright-Patterson AFB, Ohio AMRL Mar. 1971 51 p refs
(Contract F33615-69-C-1252)
(AD-727791; WDL-TR-4307; AMRL-TR-70-137) Avail: NTIS CSCL 05/8

The study was a follow-on to a previous investigation on panel layout. The original study using a continuous task defined and evaluated four principles of control panel layout: sequence of use (SEQ), functional grouping (FG), location by frequency (FREQ), and location by importance (IMP). The four principles were evaluated by factorial experiments which included stress conditions and three levels of application for each of the arrangement principles. The present study replicates the original study with the exception that the continuous task was modified to make it discontinuous. Author (GRA)

N71-37677# Connecticut Univ., Storrs.
MAN-MACHINE SYSTEMS FOR DETECTION, RECOGNITION, TRANSMISSION AND PERCEPTION OF INFORMATION, VOLUME 1 Final Report, 15 Sep. 1969 - 31 May 1971
Taylor L. Booth, Herbert M. Kaufman, Michael Drillings, David P. Kennedy, and Howard A. Sholl 30 Jun. 1971 81 p refs 4 Vol.
(Contract N00140-70-C-0204)
(AD-727809) Avail: NTIS CSCL 05/10

The report describes the results of a comprehensive research effort consisting of experimental and theoretical studies to develop man-machine techniques for processing data from sonar display systems. The following basic areas were investigated: Modeling of the human operator in sequential visual detection tasks; Compact encoding of information; Automatic methods of processing sonar data; and Visual display processing.
Author (GRA)

N71-37678# Connecticut Univ., Storrs.
MAN-MACHINE SYSTEMS FOR DETECTION, RECOGNITION, TRANSMISSION, AND PERCEPTION OF INFORMATION, VOLUME 2 Final Report, 15 Sep. 1969 - 31 May 1971
Taylor L. Booth, Herbert M. Kaufman, Michael Drillings, David P. Kennedy, and Howard A. Sholl 30 Jun. 1971 119 p refs 4 Vol.
(Contract N00140-70-C-0204)
(AD-727810) Avail: NTIS CSCL 05/10

The purpose of this study was to develop a mathematical model of perceptual information processing that might be applied to engineering problems involving the use of an operator in a signal/information processing task. Using as a foundation the more basic and general psychological findings a predictive model was formulated which interactively incorporated this past research. The model formulation described a means of characterizing the ability of people to use information both for discrimination and identification tasks. Information processing was considered in an independent manner. A sequential logarithmic means of processing information was proposed which not only agreed with the results of past research but also provided a reasonably accurate simulation of both response accuracy and response time during the experimental study. A Bayesian means of characterizing the behavioral adjustments of both response accuracy and response time was proposed which used a memory of past responses to learn the probabilities of the stimuli.
Author (GRA)

N71-37679# Connecticut Univ., Storrs.
MAN-MACHINE SYSTEMS FOR DETECTION, RECOGNITION, TRANSMISSION, AND PERCEPTION OF INFORMATION, VOLUME 3 Final Report, 15 Sep. 1969 - 31 May 1971
Taylor L. Booth, Herbert M. Kaufman, Michael Drillings, David P. Kennedy, and Howard A. Sholl Jun. 1971 132 p refs 4 Vol.
(Contract N00140-70-C-0204)
(AD-727811) Avail: NTIS CSCL 09/4

The basic definitions of probabilistic languages and grammars are given. Derivations by such grammars are demonstrated and the probability distribution over the language generated by such a grammar is shown to have a sum-of-products form. Equivalence of probabilistic grammars is discussed and transformations on such grammars are investigated. The determination of a probabilistic grammar for a specified probabilistic language is investigated and the average word length of probabilistic languages is found. The compact encoding of probabilistic languages is investigated. The concept of information lossiessness is extended to the infinite automata. Four classes of Coding Automata are defined and their operations are explained. Optimality is discussed in the coding schemes as is the type of language of the output code. The average code length of the four classes is compared. Author (GRA)

N71-37680# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
BIOENGINEERING LIFE SUPPORT SYSTEM ON SPACE SHIPS FOR PROLONGED FLIGHTS
5 Mar. 1971 11 p Transl. into ENGLISH from the pamphlet "Biologo-Tekhnicheskaya Sistema Zhiznedeyatelnosti na Kosmicheskikh Korablyakh pri Dlitelnykh Polotakh" USSR, 1970 p 2-5
(AD-727944; FTD-HT-23-92-71) Avail: NTIS CSCL 06/11

The report discusses the principles and basic components of closed-cycle life support system for long space missions. A diagram of a basic recycling system is included. Author (GRA)

N71-37681# Council on Environmental Quality, Washington, D.C.
TOXIC SUBSTANCES
Apr. 1971 33 p refs
Avail: SOD $0.40

Existing legal authorities are inadequate to deal with toxic substances. If a substance is toxic, control must often be exercised at the point of manufacture and distribution because the variety of ways in which such substances enter the environment and the difficulties of detecting many of them make effluent controls an ineffective mechanism. Also, standard-setting, monitoring, and control can often be done more efficiently and rationally if attention is focused on the particular substance rather than on the medium in which it may appear. Author

N71-37682# Civil Aeromedical Inst., Oklahoma City, Okla.
AURAL GLIDE SLOPE CUES: THEIR EFFECT ON PILOT PERFORMANCE DURING IN-FLIGHT SIMULATED ILS INSTRUMENT APPROACHES
A. Howard Hasbrook and Paul G. Rasmussen May 1971 27 p refs
(FAA-AM-71-24) Avail: NTIS

Forty instrument rated commercial and ATR pilots with 250 to 12,271 flight hours each flew ten simulated ILS approaches in a single engine, general aviation aircraft. Divided into five groups, each group used a different glide slope cue display in combination with a modified T instrument panel configuration.

Two types of aural glide slope cue displays were utilized: (1) voice, and (2) Morse code signals. No significant differences were found among the five groups relative to accuracy in glide slope tracking. There was no apparent improvement with practice. The presence of aural glide slope cues resulted in the aircraft being flown slightly higher across the middle marker than when only the conventional visual display was utilized. Localizer performance showed a slight but significant initial decrease in the presence of aural glide slope cues with respect to only one performance measure. Transition from the conventional visual cross-pointer display to the aural (voice) glide slope cues was achieved with a minimum of familiarization and with no apparent difficulty. Author

N71-37683# Federal Aviation Administration, Washington, D.C. Office of Aviation Medicine.
SENIOR AVIATION MEDICAL EXAMINERS CONDUCTING FAA FIRST CLASS MEDICAL EXAMINATIONS
G. K. Norwood Sep. 1971 5 p refs
(FAA-AM-71-38) Avail: NTIS

An FAA survey of the airlines and the number of first class medical certificate holders among their pilots is presented. The number of physical examinations performed by one physician is also recorded. FAA's proposal to modify medical regulations to allow airlines to use full-time or consultant physicians designated by the Federal Air Surgeon is evaluated and discussed. J.A.M.

N71-37684 National Lending Library for Science and Technology, Boston Spa (England).
LIGHTNING CONDUCTOR GOWN
A. Strazhev 13 Apr. 1971 3 p Transl. into ENGLISH from Pravda (Moscow), 11 Dec. 1970
(NLL-M-20436-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

A device which deviates electrostatic charges from man into the earth is described. The instrument consists of a gown with flexible electricity conducting ribbons. E.H.W.

N71-38645# Joint Publications Research Service, Washington, D.C.
PROMISING METHODS FOR WATER RECLAMATION IN SPACECRAFT LIFE SUPPORT SYSTEMS
S. V. Chizhov et al *In its* 22d Intern. Astronautical Congr. 28 Oct. 1971 p 11-18 (See N71-38642 24-30)
Avail: NTIS

N71-38646# Joint Publications Research Service, Washington, D.C.
POSSIBLE METHODS FOR APPRAISING RELIABILITY OF LONG LIVED LIFE SUPPORT SYSTEMS
B. A. Ademovich et al *In its* 22d Intern. Astronautical Congr. 28 Oct. 1971 p 19-36 refs (See N71-38642 24-30)
Avail: NTIS

N71-38647# Joint Publications Research Service, Washington, D.C.
QUALITY EVALUATION OF ERGATIC PROCESSES IN SPACE VEHICLE CONTROL
A. D. Korotkov et al *In its* 22d Intern. Astronautical Congr. 28 Oct. 1971 p 37-43 (See N71-38642 24-30)
Avail: NTIS

N71-38648# Joint Publications Research Service, Washington, D.C.
PSYCHOLOGICAL ASPECTS OF ADAPTIVE BEHAVIOR IN COMPLEX SPATIAL ENVIRONMENTS
V. I. Myasnikov et al *In its* 22d Intern. Astronautical Congr. 28 Oct. 1971 p 44-48 (See N71-38642 24-30)
Avail: NTIS

06 CHEMISTRY

Includes chemical analysis and identification (e.g., spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants.

N71-37685# Bhabha Atomic Research Centre, Bombay (India).
SPECTROGRAPHIC ANALYSIS OF HIGH PURITY EUROPIUM OXIDE
P. Sreerama Murty and P. P. Khanna 1971 9 p refs
(BARC-532) Avail: AEC Depository Libraries

A dc arc spectrographic method is described to estimate Sm, Gd, and Tb in high purity europium oxide. The sample, after being ground in the ratio 1:1 by weight with spec-pure conducting graphite powder (U.C.C. 200 mesh), is taken in a 3/16-in.-dia graphite electrode and arced against a 3/16-in.-dia graphite electrode. The spectra are photographed on a plane grating spectrograph using a 30,000 l.p.i grating in the second order in the region 3250 to 3850 A. The concentration ranges covered are: 0.005 to 0.1% for Sm and Gd; 0.01 to 0.1% for Tb. The precision of the method is + or - 10%. Author (NSA)

N71-37686*# Illinois Univ., Chicago.
THE ISOCYANO GROUP AS A CARBENOID FUNCTION CYCLIZATION OF ORTHO-ISOCYANOBIPHENYL AND DERIVATIVES
Johannes De Jong (Ph.D. Thesis) 1971 91 p refs
(Grant NGR-14-012-004)
(NASA-CR-123190) Avail: NTIS CSCL 07C

The formation of cyclohept(b)indoles by irradiation of o-isocyanobiphenyl in cyclohexane is described. It is a new reaction which reveals electrophilic properties of the isocyanide group in the excited state. It appears to be the first example of an aromatic ring expansion by insertion of an isocyano carbon. Cyclohept(b)indole is also formed upon irradiation via the initial formation of o-isocyanobiphenyl and sulfur. Irradiation of o-isocyanobiphenyl in methanol produces phenanthridine as the main product besides a small amount of cyclohept(b)indole. A theory is developed that explains the different course of the photochemical reaction in cyclohexane and methanol. Author

N71-37687*# United Aircraft Corp., East Hartford, Conn. Research Labs.
SPECTRAL ABSORPTION COEFFICIENTS OF HELIUM AND NEON BUFFER GASES AND NITRIC OXIDE-OXYGEN SEED GAS MIXTURE
N. L. Krascella Sep. 1971 86 p refs
(Contract SNPC-70)
(NASA-CR-123188; K-910904-2) Avail: NTIS CSCL 07D

The spectral properties of helium and neon as a function of pressure, temperature and wave number are studied. The spectral properties of these gases have a strong influence on radiative energy transfer in the buffer gas region of nuclear light bulb rocket engines. A computer program is formulated and used to calculate spectral absorption coefficients of helium and neon at total pressures of 50, 100, 250, 500, 750, and 1000 atm in the temperature interval between 1,000 and 30,000 K. At each pressure and temperature, spectral properties are calculated for 47 wave numbers. In addition, previous estimates of spectral characteristics of a nitric oxide-oxygen seed mixture are extended to temperatures below 10,650 R. Author

N71-37688*# Stanford Univ., Calif. Dept. of Genetics.
ELECTRON IMPACT PROMOTED FRAGMENTATION OF ALKYL-N-(1-PHENYLETHYL)-CARBAMATES OF PRIMARY, SECONDARY AND TERTIARY ALCOHOLS
W. E. Pereira, S. Halpern, M. D. Solomon, and A. M. Duffield [1971] 21 p refs
(Grant NGR-05-020-004)
(NASA-CR-123196) Avail: NTIS CSCL 07D

The mass spectra of twenty N-alkyl-(l-phenylethy)-carbamates derived form primary, secondary and tertiary alcohols have been investigated using deuterium labeling and high resolution mass spectrometry. These derivatives are suitable for the determination of the isotopic purity of primary and secondary, but not of tertiary alcohols. Several of the primary and secondary alcohol derivatives yield an ion formally equivalent to the product ion of a McLafferty rearrangement. However, deuterium labeling established that the usual site specificity associated with the McLafferty rearrangement process was lacking in these carbamate derivatives. In addition a double hydrogen rearrangement process was observed in the mass spectra of several of the carbamates derived from tertiary alcohols. Author

N71-37689*# Techtran Corp., Glen Burnie, Md.
KINETICS AND CATALYSTS OF FORMALDEHYDE CONDENSATION [KINETIKA I KATALIZATORY FORMALDEGIDNOY KONDENSATSII]
O. V. Krylov et al Washington NASA Oct. 1971 7 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (USSR), v. 199, no. 3, 1971 p 643-645
(Contract NASW-2037)
(NASA-TT-F-14001) Avail: NTIS CSCL 07D

Comparative tests on the kinetics of formaldehyde condensation in the presence of certain quantities of Ca(OH)2 and after filtration of solid precipitate formed by adding Ca(OH)2 to the mixture are described. These tests indicate that the condensation of formaldehyde to sugars is homogeneous. The effect of formaldehyde and sugars on the solubility of Ca(OH)2 was examined, and was concluded that the reaction of CH2O condensation proceeds through the intermediate formation of triose and as a triose than forms a complex with the Ca ion leading to further condensation. The catalytic activity of the hydroxides of the rare earth metals in the synthesis of carbohydrates from formaldehyde, though lower than that of the hydroxides of Ca, Sr, Ba, Pb, Tl, is higher than all other compounds tested. The investigation verifies the hypothesis that ion radius plays a deciding role in the manifestation of catalytic activity in the condensation of formaldehyde into monosaccharide. Author

N71-37690*# Translation Consultants, Ltd., Arlington, Va.
ON THE MECHANISM OF WATER DECOMPOSITION DURING THE PROCESS OF PHOTOSYNTHESIS [O MEKHANIZME RAZLOZHENIYA VODY V PROTSESSE FOTOSINTEZA]
V. M. Kutyurin Washington NASA Oct. 1971 20 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Ser. Biol. (Moscow), no. 4, 1970 p 569-580
(Contract NASw-2038)
(NASA-TT-F-14018) Avail: NTIS CSCL 07D

A scheme of water decomposition in the process of photosynthesis suggests that the mechanism of water decomposition represents a unique example of biological oxidation stimulated by the oxidized form of chlorophyll. The basic features of water decomposition are represented by a coincidence of the process of water oxidation with the photochemical stage of photosynthesis and fixation of intermediate products of water oxidation within the structure of the complex so that they do not get into the stroma space. Formation of molecular oxygen presents a more labile link as compared with water oxidation. A discrimination is shown to exist between the minimal volume of a chloroplast volume able to evolve oxygen, the quantosomes, and the optimal volume instrumental in electron transport to artificial acceptors and to the carboxyl group. The concept of a photosynthetic unit is discussed. Author

N71-37691*# Ball State Univ., Muncie, Ind. Dept. of Chemistry.
CHEMISTRY: SPACE RESOURCES FOR TEACHERS INCLUDING SUGGESTIONS FOR CLASSROOM ACTIVITIES AND LABORATORY EXPERIMENTS
Richard M. Lawrence and William H. Bowman Washington NASA Feb. 1971 228 p refs Sponsored by NASA
(NASA-EP-87) Avail: NTIS; SOD $2.50 CSCL 07D

This publication is the fourth of a series of curriculum supplements developed for NASA. It is a compilation of 10 resource units designed to enrich general chemistry instruction materials with recent space program developments. The units are arranged in a sequence of topics similar to many general chemistry textbooks and include: cabin atmospheres in space vehicles, life support systems, chemical rocket propellants, electrochemical cells for space power, rates of high temperature reactions associated with space vehicles, space vehicle lubrication, optical coatings for temperature control of space vehicles, ablative materials for high temperature thermal protection, chemical evolution, and detection of extraterrestrial life. J.G.M.

N71-37692# Dow Chemical Co., Golden, Colo. Rocky Flats Div.
ADSORPTION ON PLUTONIUM. PART 1: NITROGEN, OXYGEN, HYDROGEN, AND CARBON MONOXIDE
Richard O. Adams and Anthony DiGiallonardo 9 Jun. 1971 7 p refs
(Contract AT(29-1)-1106)
(RFP-1456) Avail: NTIS

The sticking probabilities and quantities of gas adsorbed on a clean plutonium surface are measured. Oxygen, nitrogen, hydrogen, and carbon monoxide are the adsorbing gases. The clean plutonium surface is prepared by vapor deposition in high vacuum. Author (NSA)

N71-37693# California Univ., Livermore. Lawrence Radiation Lab.
ANALYTICAL CHEMISTRY Annual Report, 1970
J. E. Harrar, comp. 5 Mar. 1971 69 p refs
(Contract W-7405-eng-48)
(UCRL-50006-71) Avail: NTIS

Projects and techniques described include developments in computer automation of mass spectrometry, vacuum fusion analysis, combustion carbon analysis, atomic absorption spectrophotometry, and interactive data processing. Analyses by high- and low-resolution mass spectrometry and gas chromatography are reported, also gas analyses at the Nevada Test Site. Studies in emission, microwave, NMR, X-ray fluorescence, luminescence, infrared, Auger, ionization, proton backscattering, atomic absorption, electron microprobe spectroscopy, and gel permeation chromatography were conducted. Further studies included wet chemical methods for inorganic, organic, and explosive materials; ion-selective electrode titrations; and determinations of low-level deuterium in water, hydrogen, and biological materials. Controlled-potential coulometry and a study of the determination of moisture in rock materials by microwave absorption were concluded. Author (NSA)

N71-37694# Union Carbide Corp., Oak Ridge, Tenn. Y-12 Plant.
THERMAL DEGRADATION AND TOXICITY ASPECTS OF VARIOUS POLYMETRIC MATERIALS
C. R. Schmitt 9 Jun. 1971 25 p refs
(Contract W-7405-eng-26)
(Y-1734) Avail: NTIS

The thermal degradation characteristics of a flexible polyurethane foam, two polyethylene trash containers, and a polystyrene packaging material were evaluated by thermogravimetric, mass spectrographic, and emission spectrographic analyses with regard to the toxic gaseous products evolved. Author

N71-37695# Israel Program for Scientific Translations, Ltd., Jerusalem.
THERMOPHYSICAL PROPERTIES OF FREON-22
A. V. Kletskii 1971 76 p refs Transl. into ENGLISH from the book "Teplofizicheskie Svoistva Freona-22" Moscow, Izd. Komitesa Standartov, 1970 p 1-87 Sponsored by NBS and

NSF
(TT70-50178) Avail: NTIS

An apparatus was designed and constructed for the study of PT and PVT relationships at low temperatures. Its operation is based on the constant-volume piezometer method. Thermodynamic properties of freon were determined. Tables of experimental data are presented. Physical properties of freon are considered as well. An example of refrigerator design calculation is given.
K.P.D.

N71-37696# Stevens Inst. of Tech., Hoboken, N.J. Dept. of Mechanical Engineering.
THE LINEAR PYROLYSIS OF AMMONIUM PERCHLORATE BY CONVECTIVE HEATING
Richard B. Cole (Ph.D. Thesis) and Robert F. Mc Alevy, III (Ph.D. Thesis) Jun. 1971 212 p refs
(Contract N00014-67-A-0202-0023)
(AD-727991; ME-RT-71005) Avail: NTIS CSCL 07/4

A new technique for investigating the linear, surface pyrolysis of ammonium perchlorate (AP) is reported along with the results of extensive testing of pressed AP at 1 atm, ambient pressure. The technique involves both convective heating by an impinging jet from a gas rocket and also surface-temperature measurement by infrared spectroradiometry. An apparent activation energy of 22 kcal/mole is reported for AP with surface temperatures between 425 and 575C and with regression rates between 0.002 and 0.04 cm/sec. The overall pyrolysis mechanism is proposed to be rate-controlled, dissociative sublimation. The technique used and the results reported are the first such for AP which allow for consideration of partial pressures and heat fluxes at the pyrolyzing surface in addition to measurements of regression rates and surface temperatures during pyrolysis. Author (GRA)

N71-37697# Royal Aircraft Establishment, Farnborough (England).
THE REDUCTION OF OXAZEPAM AT THE DROPPING MERCURY ELECTRODE [REDUKTION DES OXAZEPAMS AN DER HG-TROPFELEKTRODE]
H. Oelschlager et al Apr. 1971 11 p refs Transl. into ENGLISH from Arch. Pharm. (Weinheim), v. 12, no. 302, 1969 p 946-951
(RAE-Lib-Trans-1583) Avail: NTIS

Oxazepam is reduced at the dropping mercury electrode in a single wave. The wave-heights depend on the pH values. In acetate buffer solution with 20% dimethylformamide there is a linear dependence of wave-heights on concentration of the depolarizer. Therefore it is possible to determine polarographically Adumbran-tablets. The accuracy is equal to spectrophotometric analysis. Author

N71-37698# Research Inst. of National Defence, Stockholm (Sweden).
METAL-CATALYZED AUTOXIDATION OF HYDROCARBONS. AUTOXIDATION OF HYDROCARBONS: AUTOXIDATION OF CUMENE IN THE PRESENCE OF IRON(III) CHELATES OF BETA-DIKETONES
Goesn Aqvist Aug. 1971 4 p refs *Its* FOA Reports Vol. 5, No. 5
(FOA-1-B-1155-92; ISBN-91-7056-004-8) Avail: NTIS

The autoxidation of cumene in the presence of some iron(III) chelates of beta diketones was studied at 120 C. The reaction products and reaction rates have been determined. Experiments with various catalysts gave the same relative quantities of oxidation products, but the reaction rate varied with tye structure quantities of oxidation products, but the reaction rate varied with the structure of the catalyst. A drastic decrease in the reaction rate occurred after about 10-per cent conversion of the hydrocarbon. This seems to be caused by very complex reactions in which the catalyst and the reaction products participate. Author

N71-37699# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EMISSION SPECTRAL ANALYSIS OF PETROLEUM PRODUCTS
S. K. Kyuregyan 7 May 1971 417 p refs Transl. into ENGLISH of the book "Emissionnyi Spektralnyi Analiz Nefteproduktov" Moscow, Izd-Vo Khimiya, 1969 p 1-296
(AD-727197; FTD-MT-24-267-70) Avail: NTIS CSCL 07/4

The report deals with the emission spectral methods for determining the content of mineral admixtures in fuels, oil, lubricants, additions, sediments and other petroleum products. Cited are the concentrations and described the state of 30 elements, characteristics of their spectra, characteristic and choice of analytical pairs of bands; described are also elements impeding analysis. Author (GRA)

N71-37700# Massachusetts Inst. of Tech., Cambridge. Fluid Mechanics Lab.
EXPERIMENTAL STUDY OF THE EFFECTS OF HYDRODYNAMICS AND MEMBRANE FOULING IN ELECTRODIALYSIS
Gershon Grossman and Ain A. Sonin Jul. 1971 46 p refs
(Contracts DI-14-01-0001-1721)
(FML-Publ-71-13) Avail: NTIS

Experimental data are presented for the performance of a multicompartment electrodialysis system with laminar flow in plane, unobstructed channels. The data include current-voltage characteristics, current density distributions, and pH in the brine and dialysate effluents, for a wide range of operating conditions. The results are shown to be in good agreement with the theory of Sonin and Probstein, provided that the membranes are relatively free of surface contamination. Fouling of the membrane surfaces, induced in these experiments by iron oxide in the feed water, is shown to bring about a reduction of the limiting current by as much as a factor of two below the theoretical value. The magnitude of the decrease depends on flow speed and other operating conditions. Author

N71-37701 National Lending Library for Science and Technology, Boston Spa (England).
THE RATE OF OXIDATION OF PETROLEUM PRODUCTS IN WATER WITHOUT ADDITION OF NITROGEN
A. I. Iz'yurova 22 Sep. 1971 9 p Transl. into ENGLISH from Gig. Sanit. (USSR), no. 7, 1952 p 12-17
(NLL-NSTIC-Trans-2474-(6180.59)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The bacterial oxidation of petroleum products in water is discussed. In waters not containing nitrogen, phosphorus and potassium (N, P, K), oxidation of petroleum products did not occur. With sufficient quantities of the nutrients mentioned, bacterial oxidation of petroleum products proceeds very rapidly and the surface of the water, with a petroleum film of 2 mm in thickness is completely purified from this layer in 1-2 months. The process of oxidation of petroleum products can also occur without nitrogen, if phosphorus and potassium are present in the water. The nitrogen necessary for the process was apparently fixed from the air by bacteria. The process of the biological purification of water from petroleum products on the surface of the water, upon addition of all nutrients to the water and upon addition only of phosphorus and potassium was investigated. The petroleum product investigated was machine oil. Author

N71-37702 California Univ., Berkeley.
NONLINEAR-OPTICAL EFFECTS IN SULFUR HEXAFLUORIDE
Obert Reeves Wood, II (Ph.D. Thesis) 1969 149 p
Avail: Univ. Microfilms Order No. 70-17688

A model for the saturation of infrared absorption in a cell containing an absorbing gas (SF6) is presented. This model includes the effect of many participating rotational levels, spatial diffusion of molecules, temperature gradients, distortion of the optical beam, inhomogeneous broadening, and absorption cell geometry. Predictions based upon this model are found to be in

good agreement with results of large signal absorption measurements involving absorption of radiation from a CO2 laser by SF6 gas. Passive Q-switching of a CO2 laser using SF6 gas as a saturable absorber is described. A simple model for the time response of SF6 when used as a passive Q-switch is given and is found to predict correctly peak power, pulse width, and repetition rate. Passive mode-locking of the CO2 laser using SF6 gas as a saturable absorber is also described. In addition measurements of parameters characterizing the CO2 gain medium are given. Dissert. Abstr.

N71-38635# Naval Research Lab., Washington, D.C.
LITHIUM FLUORIDE GLOW-PEAK GROWTH DUE TO ANNEALING
L. F. Booth, T. L. Johnson, and F. H. Attix *In its* Rept. of NRL Progress, Sep. 1971 Sep. 1971 p 5-12 refs Supported in part by AEC (See N71-38633 24-30)
Avail: NTIS

07 COMMUNICATIONS

Includes communications equipment and techniques; noise; radio and communications blackout; modulation telemetry; tracking radar and optical observation; and wave propagation. For basic research see: 23 Physics, General; and 21 Navigation.

N71-37703*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
A SURVEY OF DIGITAL BASEBAND SIGNALING TECHNIQUES
H. L. Deffebach (Tenn. Univ., Tullahoma, Space Inst.) and W. O. Frost 30 Jun. 1971 38 p refs
(NASA-TM-X-64615) Avail: NTIS CSCL 17B

A brief tutorial survey of 25 basic bandbase signaling techniques were made to choose the most applicable signaling technique for a space shuttle data bus. The following baseband signalling techniques were considered: unipolar non-return-to-zero level (NRZ-L), polar NRZ-L, NRZ-mark, NRZ-space, unipolar diode NRZ, pair selected tenary (PST), time polarity control (TPC), return-to-bias (RB), biphase level (split phase or Manchester), biphase mark, biphase space, multilevel signaling, bitmary, duobinary, the general polybinary scheme, pulse duration modulation (PDM), pulse position modulation (PPM), spatial multiplexing, and sequency multiplexing. Author

N71-37704*# Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.
TECHNIQUES FOR REDUCING MIXER CONVERSION LOSS IN MILLIMETER WAVE RECEIVERS FOR COMMUNICATIONS AND RADIOMETRY Final Report, 1 Nov. 1969 - 30 Jun. 1971
R. G. Shackelford 30 Jun. 1971 60 p refs
(Grant NGR-11-002-065; Proj. A-1088-001)
(NASA-CR-111990) Avail: NTIS CSCL 17B

The performance of point-contact mixers utilizing ion bombarded crystals was investigated at 94 GHz. Calculations were made to evaluate the effects of parasitic impedances on the conversion loss of mixers utilizing p-type silicon and n-type gallium arsenide. These calculations show that a non-homogeneous crystal consisting of a high resistivity surface layer on a low resistivity chip can be employed to minimize the conversion loss of a millimeter wave mixer. Ion bombardment was employed to form the low resistivity surface layer, and the conversion losses of mixers utilizing the non-homogeneous crystals were measured as a function of the ion bombardment parameters. It was found that a relative improvement of 5-15 db in the conversion loss could be obtained for mixers formed on boron-doped silicon which had been annealed during the ion bombardment process. It was also found that rectifying junctions could only be formed on low carrier density aluminum- and boron-doped silicon which had been ion bombarded and annealed. No improvements in conversion loss were obtained for mixers formed on the ion-bombarded gallium-arsenide cyrstals. Author

N71-37708*# Bellcomm, Inc., Washington, D.C.
CODED SCANNING OF OPTICAL IMAGES
H. A. Helm 15 Oct. 1971 22 p refs
(Contract NASw-417)
(NASA-CR-123155; TM-71-1033-2) Avail: NTIS CSCL 17B

Scanning optical systems in effect make one measurement of light intensity for each resolution element in the optical scene. When the incident light levels are low or the resolution desired very high, the energy incident on one resolution element is very low and system performance is limited by the noise level of the detector element. A system is suggested which makes the same number of measurements per line but each is across the entire scan line through a coded mask. When decoded the same resolution is achieved with a significantly improved signal-to-noise ratio. It is shown that the improvement in signal-to-noise ratio over single resolution element scanning is N(1/2) where N is the number of resolution elements per line. Difference equations are given for computing high resolution masks with desirable cyclic properties for simplified implementation. Author

N71-37708# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
TELEVISION TUBE RESOLVING POWER
Ya. A. Ryftin 22 Mar. 1971 26 p refs Transl. into ENGLISH from Tekhn. Kino Televideniya (Moscow), no. 2, 1970 p 45-54
(AD-727253; FTD-HC-23-53-71) Avail: NTIS CSCL 17/2

Analysis of the problem leads to a quite obvious conclusion. Attempts to create transmitting tubes with a flat target and high (ultrahigh) resolving power are not promising. Only with changeover to scanning onto a large spherical target of a wide-angle tube in which the electron beam deflection angle can be increased in proportion to the number of lines and the optimal distance between lines do new opportunities open up for the construction of high-line-frequency tubes, which in essence will determine further progress in television engineering.
Author (GRA)

N71-37707# Naval Research Lab., Washington, D.C.
A VERSATILE C BAND RADAR TRANSMITTER
W. T. Davis, N. R. Mills, and J. A. Weston Jun. 1971 38 p
(AD-727088; NRL-MR-2278) Avail: NTIS CSCL 17/9

The C band transmitter is one of the four radar transmitters which are included in the Four-Frequency Radar System. The Four-Frequency Radar in its entirety is an airborne system capable of measuring target characteristics and terrain backscatter, and has been used in the synthetic aperture mode to map sea ice, waterborne oil pollution, and land and sea surfaces. The four radar transmitters operate at P/UHF (428 MHz), L band (1228 MHz), C band (4455 MHz), and X band (8910 MHz). Previous attempts to produce the required power and versatility at C band netted only partial success, and in due course, it was decided to replace and update the C band transmitter. A new transmitter has been produced by NRL and installed as a part of the airborne Four-Frequency Radar System. The new transmitter uses an electrostatic focused Klystron and meets its design goals while having approximately one-half the weight and cubic displacement of the older transmitter. The Four-Frequency Radar is a valuable research tool and the addition of a stable dependable transmitter in the C band region gives it the balance and continuity envisioned in its inception. Author (GRA)

N71-37709# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ELECTROMAGNETIC OSCILLATIONS IN A SPHERICAL CAVITY WITH TIME-VARIABLE RADIUS
V. N. Kreslinkio 27 Mar. 1971 29 p refs Transl. into ENGLISH from Probl. Difraktsii i Rasprostraneniya Voln

(Leningrad), no. 8, 1968 p 43-59
(AD-727269; FTD-MT-24-84-71) Avail: NTIS CSCL 20/14

A comprehensive analysis is presented for electromagnetic field behavior in a three-dimensional resonator of finite dimensions where wave diffraction phenomena appear. Primary attention is given to the problem of field amplification from a given initial level at a zero time instant due to parametric interaction between the field and the boundary. A discussion of initial and boundary conditions reveals that the fields of different spherical harmonics do not interact on the resonator boundary. The TE and TM fields remain independent of each other, and both field types can be described, proceeding from the boundary impedance conditions. This means, in effect, that diffraction phenomena are considered under the conditions existing at the boundary, which are more complex than those with a one-dimensional resonator and involves the solution of a differential-difference equation of a given order with variable coefficients. As the first step, a qualitative approach to the processes taking place in the resonator is attempted, analyzing them from the spectral viewpoint. Author (GRA)

N71-37709# Air Force Systems Command, Wright-Patterson AFB, Ohio.
THE TRANSMISSION OF LIGHT-SHADOW CONTRASTS DURING TELECINE PROJECTION
A. P. Sorenzon et al 20 Apr. 1971 24 p refs Transl. into ENGLISH from Tekhn. Kina i Televideniya (Moscow), v. 14, no. 5, 1970 p 49-54
(AD-727244; FTD-MT-24-342-70) Avail: NTIS CSCL 17/2

Analyzed are the processes of black-and-white films production and electro-optical transformation in telecine equipment from the viewpoint of transmission of light-shadow contrast. Determined are average through characteristics of negative-positive process and optimum characteristics of gamma-corrector for telecine channel. Established are conditions for optimum contrast transmission by means of maintaining the permanency of the signal level by the face reference. Author (GRA)

N71-37710# Lockheed Missiles and Space Co., Palo Alto, Calif.
SINGLE-CHANNEL PULSE RADARS WITH SPECIAL KINDS OF SIGNAL MODULATION, CHAPTER 14.
V. V. Grigorin-Risbov, (ed.) [1970] 9 p refs Transl. into ENGLISH from the book "Radiolokatsionnye Ustroistva (Teoriia i Printsipy Postroeniia)" Moscow, Sovetskoe Radio Press, 1970 p 377-391
Avail: NTIS; National Translations Center, John Crerar Library, Chicago, Ill. 60616

Optimal filters for radio pulses with linear frequency modulation are discussed and transfer functions for amplitude- and phase-frequency characteristics are presented. Radio pulses with bell-shaped and rectangular envelopes are included. Radar stations with interpulse phase manipulation are also discussed. J.M.

N71-37711# Lockheed Missiles and Space Co., Palo Alto, Calif.
SINGLE-CHANNEL PULSE RADAR STATIONS, CHAPTER 13
V. V. Grigorin-Risbov, (ed.) [1970] 34 p refs Transl. into ENGLISH from the book "Radiolokatsionnye Ustroistva (Teoriia i Printsipy Postroeniia)" Moscow, Sovetskoe Radio Press, 1970 p 329-376
Avail: NTIS; National Translations Center, John Crerar Library, Chicago, Ill. 60616

The pulse operating mode and characteristics are discussed. Disadvantages to the use of pulse radars are considered. Operating equipment is reviewed. Ordinary incoherent pulse stations, as well as coherent ones with large and small bandwidth, are examined. Equations are developed for ideal coherent reception and Doppler pulse small bandwidth radar. K.P.D.

N71-37712# National Resource Analysis Center, Washington, D.C. Information Systems Div.
ALTERNATIVE ATC CO-CHANNEL SEPARATION CRITERIA BASED ON PROBABILITY-OF-INTERFERENCE CONSIDERATIONS
Richard H. Wilcox and Marvin E. Hoepken Aug. 1970 28 p refs
(IST-101) Avail: NTIS

Current air traffic control standards for separation between locations using the same frequency are discussed. Two aspects are considered: relative signal strength differential between interfering signals, and conditions under which this differential is applied to determine acceptable ground transmitter separations. The general geometrical relationships among controlled aircraft and their respective ground transmitters are considered in order to permit analysis of the probability of interference occurring which exceeds the differential specified. High altitude enroute control is used as a vehicle for developing specific analysis procedures and resulting quantitative results. It appears that use of probability-of-interference criteria, instead of worst case, would permit reductions in co-channel RCAG separations sufficient for a minimum increase of 50 percent in use of any given frequency; if lesser signal strength differentials were accepted and normal sector traffic were considered, improvement by a factor of six might be possible for high altitude enroute service. Extension of the method to other classes of ATC service should be straightforward. Substitution of probability-of-interference criteria for separation standards represents a desirable approach to improvement because safety is not compromised. Author

N71-37713# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DYNAMIC AND WORKING CHARACTERISTICS OF SUPERORTHICONS
P. L. Sokolov et al 16 Mar. 1971 15 p refs Transl. into ENGLISH from tekhn. Kino i Televideniya (Moscow), no. 3, 1970 p 48-50
(AD-727173; FTD-MT-24-334-70) Avail: NTIS CSCL 17/2

To correctly estimate the work of the tube and choose optimum working light intensivity there are suggested new working characteristics instead of dynamic ones. The estimation of the tube work according to these characteristics gives a good coincidence with the subjective estimation of the image quality. GRA

N71-37714# Lockheed Missiles and Space Co., Palo Alto, Calif.
PASSIVE RADAR, CHAPTER 17
V. V. Grigorin-Risbov, (ed.) 1970 10 p refs Transl. into ENGLISH from the book "Radiolokatsionnye Ustroistva (Teoriia i Printsipy Postroeniia)" Moscow, Sovetskoe Radio Press, 1970 p 471-484
Avail: NTIS; National Translations Center, John Crerar Library, Chicago, Ill. 60616

The passive radar process of detecting and measuring the coordinates of an object on the basis of receiving its intrinsic radio radiation is discussed. The terminology passive radar can also be understood to be the domain of radio engineering which solves this problem. The main causes for the intrinsic radio radiation of objects are thermal radio emission, radiation associated with large aerodynamic perturbations, and the radiation of different-purpose transmitters mounted on the objects. All physical bodies whose temperature differs from absolute zero emit radiowaves. The radio emission intensity increases as the body temperature rises, and depends on its emissivity. Thermal radio emission has a broad spectrum extending from infrared to centimeter wave bands. The spectral distribution of the emission intensity is approximately inversely proportional to the wavelength. The power emitted by bodies in the centimeter band utilized in radar is less than 1% of the power emitted at higher frequencies. An absolutely black body is an ideal emitter. The emissivity of objects is estimated by comparison with the emission of an absolutely black body. The emissivity of an object at a temperature T, is the ratio between the power of its emission, P, in a given frequency band and the emission power p sub zero of an

absolutely black body at the same temperature and in the same frequency band. Author

N71-37715# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
REGULATION OF THE PERMISSIBLE DROP IN THE BRIGHTNESS OF THE OBJECT OF A TELEVISION TRANSMISSION
G. R. Shakhparunyants 8 Apr. 1971 17 p refs Transl. into ENGLISH from Tekhn. Kino i Televideniye (Moscow), v. 14, no. 4, 1970 p 57-60
(AD-727435; FTD-MT-24-328-70) Avail: NTIS CSCL 17/2

Discussed are the problems of regulating admissible brightness difference of important details in the object for television transmission. Author (GRA)

N71-37716# General Electric Co., Santa Barbara, Calif.
WEDCOM PROPAGATION MODEL IMPROVEMENT
B. Gambill and R. Rutherford Jul. 1971 64 p refs
(Contract DASA01-69-C-0132)
(AD-727627; Doc-71-TMP-27; DASA-2682) Avail: NTIS CSCL 20/14

The report describes methods for improving and extending the WEDCOM MB computer code. Included are methods for adding calculations for an elevated horizontal antenna and for improving calculations of reflection coefficients. An improved procedure for solving the mode equation when the ground conductivity is very low is also described. Author (GRA)

N71-37717# Varian Associates, Palo Alto, Calif. Tube Div.
TRANSMITTER TUBE FOR TROPOSCATTER APPLICATION
Triannual Report, 8 Oct. 1970 - 7 Jan. 1971
A. Goldfinger and M. Levin Jul. 1971 59 p refs
(Contract DAAB07-70-C-0228)
(AD-727701; ECOM-0228-2; Rept-2) Avail: NTIS CSCL 09/1

Magnet studies were concluded and a yoke electromagnet whose coils are wound with copper foil was selected for the high efficiency demonstration tube. The yoke and coil structures were designed and ordered. A rare earth magnetic study program was initiated during this period. The results of this study will indicate whether or not permanent magnet focusing can be used in the future. Tuner analysis led to the choice of an inductive sliding contact tuner to be evaluated in the high efficiency demonstration klystron. Rapid and simplified tuning schemes were studied and a design approach selected. A paper design was completed to show compatibility with the electrical design. The paper design was satisfactory but will not be constructed or demonstrated during Phase II. A coolant study was completed and Dowtherm 209 was selected as a satisfactory coolant for the present high efficiency design. A combined vapor-phase, convection-cooled system was selected as a practical compromise for Phase II demonstration. Author (GRA)

N71-37718# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ON ONE ALGORITHM OF A STATISTICAL MODEL FOR GROUPING BURSTS OF ERRORS DURING TRANSMISSION OF DIGITAL INFORMATION
T. A. Valiev et al 11 Mar. 1971 17 p Transl. into ENGLISH from Vopr. Kibernetiki i Vychislitelnoi Matematiki (Tashkent), no. 14, 1967 p 65-73
(AD-727988; FTD-MT-24-357-70) Avail: NTIS CSCL 09/4

The problem is presented of constructing a universal statistical model adequate for a wide class of communication channels and retaining the structure of the errors in them. Such a model is convenient for research because of the possibility of substituting the real parameters of errors of the actual communication channel. Two methods of superposition of errors on the signal in th model of the communication channel are discussed. Author (GRA)

N71-37719# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE GTT 6000/1920 (DRUZHBA) MICROWAVE SYSTEM
V. V. Petrov et al 29 Jan. 1971 20 p Transl. into ENGLISH from the publ. "Papers of the 4th Colloquium on microwave Communications, Budapest, Hungary, 21-24 April 1970. Section on Communication Systems/Modems/Data Compression" Budapest, 1970 p 1-14
(AD-727411; FTD-HT-23-76-71) Avail: NTIS CSCL 17/2

After describing in detail the technical specifications and performance capabilities of the Soviet- and Hungarian- produced 'Druzhba' microwave system, the author cites the more important results of a test operation of the equipment over an experimental link in the Soviet Union in the 1968-1969 period. GRA

N71-37720# Naval Ship Research and Development Center, Washington, D.C.
OPTIMUM LINEAR AMPLITUDE CONTINUOUS BLOCK CODES
Sidney Berkowitz May 1971 54 p
(AD-727980; NSRDC-3615) Avail: NTIS CSCL 09/4

In transmitting data--say, speech or sonar signals--over a noisy channel, or in making measurements with imprecise instruments, i.e., instruments subject to a fluctuating error having some statistical regularity, it is possible to improve the accuracy of reception or measurement at the expense of bandwidth by a redundant mapping of the original signal space into a higher-dimensioned space. The mapping considered in this report is a linear transformation of a vector of unquantized signal samples. The transformation is called a linear amplitude-continuous (LAC) block code, and takes the form of a real-valued, rectangular matrix transformation A of a vector of real-valued, zero-mean signal samples with covariance matrix R sub x such that the average signal input/output power ratio is invariant over the coding process. A special class of LAC codes, called orthogonal codes, is constrained by (A sup T)A is proportional to I. Author (GRA)

N71-37721# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE PTU-8G TELEVISION UNIT
I. N. Pustynskii et al 4 Mar. 1971 17 p refs Transl. into ENGLISH from Tekhn. Kino i Televideniye (Moscow), no. 4, 1970 p 66-69
(AD-727963; FTD-MT-24-330-70) Avail: NTIS CSCL 17/2

Outlined are results of designing television installation PTU-8G intended for observation of objects through the well of 100 mm in diameter and up to 50 m depth. Television installation is designed on transistors. Described are the construction of television camera, the circuit of video amplifier and frame scanning of the monitor. GRA

N71-37722# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
FUNDAMENTALS OF RADAR
A. P. Sivers et al 11 Jun. 1971 525 p refs Transl. into ENGLISH of the mono. "Osnovy Radiolokatsii" Leningrad, 1959 p 1-351
(AD-727869; FTD-MT-24-293-70) Avail: NTIS CSCL 17/9

The book discusses the fundamental principles of radar. Examined are pulse, frequency and phase methods of measuring range to objects and methods of determining the azimuth and elevation of objects. Visual methods of determining coordinates and the automatic tracking of objects are examined. Errors in measuring coordinates by radar methods and factors determining the range of radar sets are analyzed. A discussion is given of the jamming of radar and methods to counteract it, the application of radar reconnaissance, the relaying of radar data and the application of radar beacons and systems for identifying equipment of objects. Some attention is given to the selection of moving objects. The studying radar and for a wide range of electronic specialists. Author (GRA)

N71-37723# Scope Electronics, Inc., Reston, Va.
VOICE INITIATED COCKPIT CONTROL AND INTERROGATION (VICCI) SYSTEM TEST FOR ENVIRONMENTAL FACTORS Final Report, 16 Feb. 1970 - 30 Apr. 1971
James W. Glenn, Ronald N. Gordon, and Gabriel Moschetti
30 Apr. 1971 112 p refs
(Contract N00019-70-C-0426)
(AD-727574) Avail: NTIS CSCL 17/2

The objectives of the contract were to investigate the effects of the pilot's acoustic environment, optimize system parameters for operation in the cockpit environment, provide system performance statistics, and investigate the availability of on-board computing systems which may be utilized. Voice data were recorded in aircraft cockpits and in an altitude test chamber. These data were analyzed to determine the effects of the environment and of physiological stresses experienced by the speakers. The results of the analyses determined modifications to be made to a simulated voice control system. The recorded data were then processed by the simulated system to obtain performance statistics. Lack of positive control over environmental variables and the inability to provide an immediate indication of system response to the speaker resulted in a data base inadequate to support statistically significant results. However it was noted that the main sources of interference to reliable speech recognition in the cockpit environment are sounds made by the pilot's oxygen supply equipment and his own breathing sounds. Methods for accommodating such sources ar suggested. Author (GRA)

N71-37724# Naval Research Lab., Washington, D.C.
SOME POSSIBLE PROPAGATION ASSOCIATED CONSTRAINTS ON ELF COMMUNICATIONS Final Report
John R. Davis, Edwin L. Althouse, and Donald R. Uffelman
14 Jul. 1971 41 p refs
(AD-727571; NRL-7269) Avail: NTIS CSCL 17/2

The first phase of a study directed toward determining the effects of the propagation medium on a possible ELF communications system was completed. A review of current theory and of the small amount of appropriate experimental information available shows that a large degree of uncertainty must be resolved before it can be considered that the characteristics of ELF propagation, even under simple, idealized ionospheric conditions, are understood. Likely extremes of propagation-associated uncertainties in ELF communications reliability and the probable occurrence of bidirectional propagation were considered. Author (GRA)

N71-37725# National Oceanic and Atmospheric Administration, Boulder, Colo.
OBSERVATIONS OF SIMULTANEOUS SCINTILLATION ON VHF AND S-BAND SATELLITE TRANSMISSIONS AT HIGH LATITUDES
J. H. Pope and R. B. Fritz Nov. 1970 35 p refs
(NOAA-TR-ERL-207-OD-6) Avail: SOD $0.45

Signal strength records obtained from ESSA 9 and ITOS 1 at .1695 and 137 MHz were analyzed to determine amplitude scintillations in the S-band region and make comparisons with scintillations in the VHF region. The S-band elevation angle dependence, bearing angle dependence, and diurnal variations for the 40-day period of the study were determined and were found to agree well with the same parameters for VHF. Instrumental limitations imposed an amplitude threshold below which it was difficult to observe scintillations on S-band. During times when the S-band scintillations did exceed this threshold, the simultaneous scintillations on VHF tended to be near saturation. Under such conditions it was found that the weak scatter theory, which would predict an exponent in the power law dependence between 1 and 2, failed. In general, the S-band scintillation amplitudes were about 1/10 of the VHF scintillation amplitudes. Author

N71-37726# National Oceanic and Atmospheric Administration, Boulder, Colo.
A PORTABLE, FREQUENCY-COHERENT SPECTRUM ANALYZER FOR RADAR APPLICATIONS
Ben B. Baisley Mar. 1971 19 p
(NOAA-TR-ERL-204-AL-5) Avail: SOD $0.30

A portable device is described that can be connected to a conventional pulsed-radar system to obtain frequency-coherent radar returns. The device was designed to record the analog frequency-coherent radar returns onto magnetic tape for subsequent spectral analysis. Although the design criteria were chosen for VHF radar investigation of the earth's ionosphere, the system is easily adaptable to other types of investigation wherever the spectral analysis of radar returns is desirable. Author

N71-37727# Grumman Aerospace Corp., Bethpage, N.Y. System Sciences Section.
LIMITATIONS IMPOSED ON THE RESOLUTION OF COHERENT RADAR SYSTEMS BY ATMOSPHERIC TURBULENCE
M. R. Wohlers Oct. 1971 38 p refs
(RM-520) Avail: NTIS

The limitations imposed by atmospheric turbulence on the resolution of those coherent radar systems that sense the wave front 'tilt' or angle-of-arrival of the return signal from a target are considered. The theoretical analysis led to analytic expressions containing the parameters that describe the extent of the atmospheric turbulence and that can be used to determine if a limit exists on the resolution, and if so the magnitude of the smallest resolvable length. Author

N71-37728# National Research Council of Canada, Ottawa (Ontario).
THE STRUCTURE OF SOLAR RADIO BURSTS ON A WAVELENGTH OF 10 cm [STRUKTURA VSPLESKOV RADIOIZLUCHENIYA SOLNTSA NA VOLNE 10 sm]
Yu. F. Yurovskii 1971 27 p refs Transl. into ENGLISH from Izv. Krymsk. Astrofiz. Observ. (Moscow), v. 40, 1969 p 147-160
(NRC-TT-1485) Avail: NTIS

A large radio telescope was used to investigate radio bursts on a wavelength of 10 cm. The following conclusions were drawn (1) a decrease in flux density can either precede or follow the pulse burst; (2) screening of the radio source of the S-component is observed comparatively, (3) a radio event associated even with a small flare is sometimes complex and consists of a simple impulsive burst, post-burst absorption and a secondary maximum of emission, (4) impulsive and secondary bursts originate at different positions on the solar disc, and (5) in terms of the investigated characteristics, the secondary burst, which occurs even after a weak flare, is reminiscent of type IV radio emission. Author

N71-37729 Alabama Univ., University.
THEORY AND ANALYSIS OF AM-BASEBAND SYSTEMS
William Harrington Tranter (Ph.D. Thesis) 1970 142 p
Avail: Univ. Microfilms Order No. 70-17948

The process of coherently demodulating a suppressed carried AM baseband is analyzed. Carrier synthesis from a pilot and from AM modulated carriers is considered in the presence of additive noise and baseband recorder flutter. The results illustrate the magnitude of phase error in the demodulation carrier arising from each source, and the design parameters which minimize this error. The manner in which automatic gain control affects an AM baseband system is studied for first and second order loops. Tracking error is investigated using an analytical approach for the first order loop and computer simulation for both first and second order loops. Results presented include curves which illustrate the relationship between tracking error and various system parameters. Steady state errors and the dependence of the time constants upon the loop input are also investigated. Dissert. Abst.

N71-37730 Purdue Univ., Lafayette, Ind.
MULTIPOLE METHODS FOR ELECTROMAGNETIC SCATTERING FROM CYLINDERS NEAR PLANES

Kenneth Robert Kelly (Ph.D. Thesis) 1970 143 p
Avail: Univ. Microfilms Order No. 70-18690

Solutions are formulated, by both the multiple scattering method and an eigenfunction method, for the scattering from an infinite perfectly conducting cylinder over a dielectric half-space and from an infinite dielectric cylinder imbedded in a dielectric half-space. In each case the axis of the cylinder is considered to be parallel to the surface of the half-space. For simplification, the incident electromagnetic wave is assumed, in each case, to be a plane wave with the E-field polarized parallel to the axis of the cylinder. Numerical results are presented, in the form of radar width, for the case of the perfectly conducting cylinder over the dielectric interface. The approximate radar cross section from a finite perfectly conducting cylinder over a dielectric half-space is obtained. Dissert. Abstr.

N71-37731 British Broadcasting Corp., Kingswood (England). Research Dept.
A FEASIBILITY STUDY OF AN ADAPTIVE RECEIVING SYSTEM FOR UHF TELEVISION
D. E. Susans and J. G. Spencer 1971 14 p refs
(RA-84; Rept-1971/32) Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

An investigation into the feasibility of producing an adaptive receiving system for u.h.f. television suitable for rebroadcast links in situations where, with standard techniques, there would be unacceptable interference is described. The system is designed to adjust continuously the directivity pattern of a receiving aerial array so as to steer minima onto the bearings of unwanted transmission. An experimental equipment was constructed and shown to work successfully. Its design and performance are discussed and suggestions are made for an improved system designed to overcome some limitations in its performance. The field of application to rebroadcast links is discussed. Author

N71-37732 British Broadcasting Corp., Kingswood (England). Research Dept.
UHF RELAY STATION AERIALS: THE COMPENSATION OF A 914 mm DIAMETER AERIAL CYLINDER BY MEANS OF AN INDUCTIVE GRATING
N. H. C. Gilchrist and J. H. Moore 1971 7 p refs
(RA-87; Rept-1971/33) Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

Reflections within the cylinder affect the impedance and radiation pattern of the aerial when it is mounted inside a dielectric cylinder. Theoretical and practical aspects of the use of inductive gratings at the surface of such a cylinder are presented together with the results of measurements conducted on aerials in cylinders equipped with gratings, showing that a useful degree of compensation of the effects of the cylinder is practicable.
Author

N71-37894# Warsaw Univ. (Poland). Dept. of Radio- and Television Technics.
A SYSTEM FOR DIRECT MEASUREMENT OF THE DIFFERENTIAL DOPPLER FREQUENCY
A. J. Fiok *In* Max-Planck-Inst. fuer Aeronomie Future Appl. of Satellite Beacon Expt. Nov. 1970 6 p (See N71-37883 24-13)
Avail: NTIS HC $6.00/MF $0.95

N71-37897# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany).
RECEIVING EQUIPMENT FOR NWL-SATELLITES
Helge Hasnael *In* Max-Planck-Inst. fuer Aeronomie Future Appl. of Satellite Beacon Expt. Nov. 1970 6 p refs (See N71-37883 24-13)
Avail: NTIS HC $6.00/MF $0.95

N71-37900# University Coll. of Wales, Aberystwyth.
A LOW ANGLE PROPAGATION EFFECT OF SATELLITE TRANSMISSIONS
L. Kersley and K. J. Edwards *In* Max-Planck-Inst. fuer Aeronomie Future Appl. of Satellite Beacon Expt. Nov. 1970 7 p refs (See N71-37883 24-13)
Avail: NTIS HC $6.00/MF $0.95

N71-37903# Kiruna Geophysical Observatory (Sweden).
LOW ELEVATION OBSERVATIONS OF THE EARLY BIRD GEOSTATIONARY SATELLITE
Sixten Olsson *In* Max-Planck-Inst. fuer Aeronomie Future Appl. of Satellite Beacon Expt. Nov. 1970 11 p (See N71-37883 24-13)
Avail: NTIS HC $3.00/MF $0.95

N71-37906# Consiglio Nazionale delle Ricerche, Florence (Italy). Ist. di Ricerca sulle Onde Elettromagnetiche
IONOSPHERIC RESEARCH WITH PROPAGATION EXPERIMENT FROM SATELLITE OUT OF THE STATION HORIZON
P. F. Pellegrini *In* Max-Planck-Inst. fuer Aeronomie Future Appl. of Satellite Beacon Expt. Nov. 1970 12 p refs (See N71-37883 24-13)
Avail: NTIS HC $3.00/MF $0.95

N71-37909# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany).
THE INFLUENCE OF ATMOSPHERE ON THE ACCURACY OF A SATELLITE TRACKING SYSTEM
P. Edenhofer, D. Gleaner, and V. Stein *In* Max-Planck-Inst. fuer Aeronomie Future Appl. of Satellite Beacon Expt. Nov. 1970 11 p refs (See N71-37883 24-13)
Avail: NTIS HC $3.00/MF $0.95

N71-37914# Max-Planck-Institut fur Aeronomie, Lindau Uber Northeim (West Germany). Abteilung fuer Weltraumphysik.
PROPOSAL FOR A RECEIVING EQUIPMENT SUITABLE FOR RADIO SIGNALS OF THE GEOSTATIONARY SATELLITE ATS-F FOR A DETERMINATION OF THE TOTAL ELECTRON CONTENT OF THE IONOSPHERE AND MAGNETOSPHERE
G. Schmidt *In its* Future Appl. of Satellite Beacon Expt. Nov. 1970 13 p (See N71-37883 24-13)
Avail: NTIS HC $3.00/MF $0.95

N71-37919# Polish Academy of Sciences, Warsaw. Inst. of Geophysics.
DISCUSSION NOTE ON SMALL FREQUENCY FLUCTUATIONS OF SATELLITE RADIO SIGNALS
A. W. Wernik *In* Max-Planck-Inst. fuer Aeronomie Future Appl. of Satellite Beacon Expt. Nov. 1970 9 p refs (See N71-37883 24-13)
Avail: NTIS HC $3.00/MF $0.95

08 COMPUTERS

Includes computer operation and programming; and data processing. For applications, see specific categories. For related information see also: 19 Mathematics

N71-37733*# Aerojet-General Corp., Azusa, Calif. Power Systems Div.
PROGRAM DESCRIPTION OF THE MODIFIED THERMAL ANALYZER DIGITAL COMPUTER PROGRAM
N. K. Rumpf 18 Sep. 1970 117 p
(Contract NAS3-13488)
(NASA-CR-72944; AGC-TM-7975:70-639) Avail: NTIS CSCL 09B

The thermal analyzer program (TAP) has undergone a series

of modifications for operation on the IBM 360/65. The modifications have increased its flexibility to handle a variety of heat transfer problems, reduced the cost of running the program, reconstructed the program layout to facilitate further changes, and streamlined the data input to the program. The programming performed to achieve these results is described. Subroutine level flow charts are included along with a program listing. Author

N71-37734*# Aerojet-General Corp., Azusa, Calif. Power Systems Div.
MODIFIED THERMAL ANALYZER DIGITAL COMPUTER PROGRAM (TAP)
D. E. Knittle 10 Nov. 1969 116 p
(Contract NAS5-417)
(NASA-CR-72916; AGC-TM-4942:69-602) Avail: NTIS CSCL 09B

The thermal analyzer digital computer program (TAP) is described which solves n-dimensional transient or steady-state heat flow problems involving any of the three modes of heat transfer, by creating an electrical analogy of the thermal problem which is to be solved, and then solving the problem by the finite differences technique. The program is coded in Fortran 4 for use on an IBM-360/65 computer. The program is of a general nature and can be used to solve many unrelated complex transient or steady state heat transfer problems. Author

N71-37735*# Aerojet-General Corp., Azusa, Calif.
MUFAN, A COMPUTER PROGRAM FOR THE ANALYSIS OF MULTI-LOOP FLUID FLOW SYSTEMS
D. G. Michaels 21 Jun. 1971 117 p refs
(Contract NAS3-13458)
(NASA-CR-72943; AGC-TM-7975:70-644) Avail: NTIS CSCL 09B

MUFAN may be used to determine flow rates, pressures, and pressure drops in systems involving one-dimensional incompressible steady state fluid flow. The system may consist of one or more branches or loops. The program is coded in FORTRAN 4 (G) for the IBM 360/65 computer. Author

N71-37736*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
AN INTERACTIVE GRAPHICAL DATA SET MAINTENANCE PROGRAM
Edgar M. Greville (Computer Science Corp.) and Clarence Groover Sep. 1971 62 p
(NASA-TM-X-65723; X-670-71-406) Avail: NTIS CSCL 09B

A description of the interactive Graphical Data Set Maintenance Program is presented, and its application in the Goddard Experiment Package Operation Scheduling System for the OAO-B satellite is discussed. Author

N71-37737*# Computer Sciences Corp., Huntsville, Ala. Aerospace Systems Center.
SPACEBORNE COMPUTER MULTI-ELEMENT SYSTEM CONFIGURATION ARCHITECTURE REFINEMENT, TASK 1 REPORT
J. R. Kennedy, Sr., R. T. Curran, B. P. Buckles, and W. A. Hornfeck 30 Sep. 1971 130 p refs
(Contract NAS8-26698)
(NASA-CR-121016) Avail: NTIS CSCL 09B

An architectural study is presented of a spaceborne computer system operating in a multi-element configuration. The system is described in prose and illustrated in functional flowcharts and diagrams. Requirements for high reliability and minimal Space Ultrareliable Modular Computer logic impact are the major guidelines. The system comprises several SUMC central processor units, several input/output processors, a single system control unit, and several main memory units. The Central Processing Unit architecture is described in terms of modifications to microinstruction fields, many memory access, process control, input/output, configuration control, and scratch pad memory organization. Author

N71-37738*# United Aircraft Corp., East Hartford, Conn. Research Labs.
COMPUTER PROGRAM MANUAL: TRANSIENT MODEL OF HYDROGEN/OXYGEN REACTOR
E. J. Smith and A. S. Kesten Feb. 1971 108 p
(Contract NAS3-13317)
(NASA-CR-120800; UARL-K910982-13) Avail: NTIS CSCL 09B

A machine computational program was developed to calculate temperature and reactant concentrations as functions of time and axial position in typical catalyzed hydrogen-oxygen reaction chambers. The program is based upon a transient model of the reactor system which describes the behavior of reactors operated under conditions of continuous flow. The computer program developed from the model is described in detail. Operating instructions for the program as well as descriptions of input and output formats, including all output messages are included. Author

N71-37739*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
COMPUTING QUADRATIC PROGRAMMING PROBLEMS: LINEAR INEQUALITY AND EQUALITY CONSTRAINTS
Richard J. Hanson 9 Feb. 1970 34 p refs
(Contract NAS7-100)
(NASA-CR-123214; JPL-TM-240) Avail: NTIS CSCL 09B

A computational method for the general quadratic programming problem with linear (inequality and equality) constraints is presented. These problems can be reformulated as hard core quadratic programs which involve minimizing a sum of squares of the unknown parameters subject to inequality constraints alone. This hard core problem is solved and the solution can be obtained by explicit linear transformations and translations to the original coordinates. An application of (least squares) constrained curve fitting (by general cubic splines) is presented. Author

N71-37740# Sandia Corp., Albuquerque, N.Mex.
ELI-44: A COMPUTER CONTROLLED INSTRUMENT SYSTEM
D. G. Dykes May 1971 12 p
(SC-DR-70-862) Avail: NTIS

The ELI-44 computer-controlled test system was designed primarily to measure Hi-Pot leakage current, contact resistance, diode forward voltage drop and reverse current; and, for motorized rotary switches, transfer time and peak and steady-state motor current. The computer and interface system may also be used to control other testing equipment such as in relay testers, battery testers, etc. Author

N71-37741# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
PDP-9/GOULD 4800 DEVICE HANDLER AND GRAPHICS LIBRARY
L. H. Gerhardstein Mar. 1971 49 p refs
(Contract AT(45-1)-1830)
(BNWL-B-58) Avail: NTIS

The GOULD 4800 graphic line printer which was added to the WADCO PDP-9/AD-4 hybrid computer, and which is used for hybrid and digital simulation is described. The graphic subroutines listed include solid straight lines, individual dots, character from user defined character generation table, characters from ASCII character generation, and real time or nonhyphen real time graphics. An example of graphics routine is also included. F.O.S.

N71-37742# Information Processing Association of Israel, Jerusalem.
PROCEEDINGS OF THE NATIONAL CONFERENCE ON DATA PROCESSING
Asa Kasher, ed. (Bar-Ilan Univ.) 1970 478 p refs Partly in ENGLISH; partly in HEBREW Conf. held in Tel-Aviv, 12 Oct. 1970

Avail: NTIS HC $6.00/MF $0.95

CONTENTS:

1. TECHNOLOGICAL FORECAST 1970 I. L. Auerbach (Auerbach Corp.) p E1-E18 (See N71-37743 24-08)

2. MADAP: A COMPUTERIZED AIR-TRAFFIC CONTROL SYSTEM L. Borocin (Eurosystems) p E19-E33 (See N71-37744 24-21)

3. THE IMPACT OF AUTOMATION UPON HEALTH DELIVERY SYSTEMS IN THE 1970's N. M. Trowe (Med. and Applied Res. System, Inc.) p E35-E45 (See N71-37745 24-04)

4. A GENERAL APPROACH TO HEURISTIC RESOURCE ANALYSIS R. Karny (Inform. Process. Assoc. of Israel) p E47-E60 refs (See N71-37746 24-08)

5. APL: BASIC CHARACTERISTICS AND APPLICATIONS TO MATHEMATICAL PROGRAMMING AND TO DATA PROCESSING E. Sharon (Hebrew Univ.) p E61-E90 refs (See N71-37747 24-08)

6. A "COMPUTER-SYSTEM LANGUAGE" (CSL): A LANGUAGE FOR JOB CONTROL N. Minsky and I. Rotbard (Hebrew Univ.) p E91-E99 ref (See N71-37748 24-08)

7. MANAGEMENT INFORMATION SYSTEMS N. S. Prywes (Penns. Univ.) p E101-E109 refs (See N71-37749 24-08)

8. AUTOMATIC READING OF HANDWRITTEN HEBREW A. J. van der Toorn (Neth. Postal and Telecommunications Service) p E111-E126 refs (See N71-37750 24-08)

N71-37743# Auerbach Corp., Philadelphia, Pa.
TECHNOLOGICAL FORECAST 1970
Isaac L. Auerbach *In* Inform. Process. Assoc. of Israel Proc. of the Natl. Conf. on Data Process. 1970 p E1-E18 (See N71-37742 24-08)
Avail: NTIS HC $6.00/MF $0.95

Projected long term accomplishments and the resulting economic payoff envisioned for new concepts of computer information systems are discussed. New development goals in memories, control elements, peripheral devices, and computerized data communications systems are outlined. Emphasis is placed on adaptive communication system design concepts containing micro sequences and read-only micro program memories with multiple algorithms existing simultaneously in the machine structure. These special purpose design adapt the computer effectively to the required task and cause a reduction in software and programming plus higher speed execution of these tasks.
G. G.

N71-37744# Eurosystem, Paris (France).
MADAP: A COMPUTERIZED AIR-TRAFFIC CONTROL SYSTEM c21
Leon Borocin *In* Inform. Process. Assoc. of Israel Proc. of the Natl. Conf. on Data Process. 1970 p E19-E33 (See N71-37742 24-08)
Avail: NTIS HC $6.00/MF $0.95

MADAP - Maastricht Automatic Data Processing and Display System in a real time system intended to facilitate the air traffic control in the upper airspace of a region covering Belgium, Luxemburg, the Netherlands and the Federal Republic of Germany. The goal of the system is to help the human controller in memorizing all the elements of the situation, to present synthetic information for quick decision making, and to initiate a warning when a decision has to be made. The system uses for input flight plans, radar data, meteorological data, and radio links with aircrafts. Its subfunctions are divided in such a way that each corresponds to a programming module of three to four thousand instructions. An extension of the system is projected by replacing older computers with newer hardware having strong storage facilities.
G.G.

N71-37745# Medical and Applied Research System, Inc., Rockville, Md.
THE IMPACT OF AUTOMATION UPON HEALTH DELIVERY SYSTEMS IN THE 1970'S c04
Neil M. Trowe *In* Inform. Process. Assoc. of Israel Proc. of the Natl. Conf. on Data Process. 1970 p E35-E45 (See N71-37742 24-08)
Avail: NTIS HC $6.00/MF $0.95

The application of computer automatic in health delivery systems, as diagnostic aid or for use in patient care is discussed on an international basis. Efficient medical information systems are able to display for any person in the file the following information: (1) a list of available information form file; (2) vital individual administrative data; (3) critical medical data; (4) a list of in-patient care visits; (5) a list of out-patient care visits; and (6) a list of X-ray examinations. It is shown that future medical record keeping involves time-sharing rather than individual computers for each hospital or office. Great advances are also foreseen in automatic cardiovascular diagnostics and the development of computer programs for problems of differential diagnosis based on the highly complex mathematics of Bayesian probabilities. Computer use as monitor in the operating room situations is also projected.
G.G.

N71-37746# Information Processing Association of Israel, Jerusalem.
A GENERAL APPROACH TO HEURISTIC RESOURCE ANALYSIS
R. Karny (IDC, USA) *In its* Proc. of the Natl. COnf. on Data Process. 1970 p E47-E60 refs (See N71-37742 24-08)
Avail: NTIS HC $6.00/MF $0.95

A general approach to network scheduling when resources are to be limited or levelled has been described. The user is given the means to guide the computations by determining the order in which activities will compete for resources and using a decision table to manipulate the scheduling decisions. Although such scheduling is heuristic, the creation of associated schedules enables some improvement to be made in the solutions obtained. From the critical set of activities obtained, some sort of path can be traced through the network, on a chronological sequence basis. This path will be found to follow along a network chain, jumping to another part of the network at those points where resource bottlenecks have been the deciding factor. The user can thus concentrate on those time and resource factors contributing to the critical sequence, and reduce the project duration or maximum requirement by suitable redeployment and rearrangement of activities, their durations and resource rates.
Author

N71-37747# Hebrew Univ., Jerusalem (Israel).
APL: BASIC CHARACTERISTICS AND APPLICATION TO MATHEMATICAL PROGRAMMING AND TO DATA PROCESSING
Emanuel Sharon *In* Inform. Process. Assoc. of Israel Proc. of the Natl. Conf. on Data Process. 1970 p E61-E90 refs (See N71-37742 24-08)
Avail: NTIS HC $6.00/MF $0.95

APL is an implementation of a problem oriented language with an algebraic structure. The language was used for a formal description of system 360 in 1964; system is described and its computational applications are demonstrated. Some early attempts to use the language as mathematical programming language and as a tool of communication in commercial data processing are outlined. An interesting implementation of a statistical package is also included.
Author

N71-37748# Hebrew Univ., Jerusalem (Israel). Computation Center
A "COMPUTER-SYSTEM LANGUAGE" (CSL): A LANGUAGE FOR JOB CONTROL
Naftaly Minsky and Itzhak Rotbard *In* Inform. Process. Assoc. of Israel Proc. of the Natl. Conf. on Data Process. 1970 p E91-E99 ref (See N71-37742 24-08)
Avail: NTIS HC $6.00/MF $0.95

A programming language for job control is described that is able to communicate with the computer system and to activate it. This computer system language has the general characteristics

of a programming language, has access to all the functions and resources of the computer system, serves as a standard communication vehicle between all the parts of the job, and is oriented towards job construction. A computer language, designed according to these principles was implemented on the CDC/6000 SCOPE system and is described in detail. G.G.

N71-37749# Pennsylvania Univ., Philadelphia. Moore School of Electrical Engineering
MANAGEMENT INFORMATION SYSTEMS
Noah S. Prywes *In* Inform. Process. Assoc. of Israel Proc. of the Natl. Conf. on Data Process. 1970 p E101-E109 refs (See N71-37742 24-08)
(N00014-67-A-0216-0007)
Avail: NTIS HC $6.00/MF $0.95

MIS is a generic concept. It applies to the acquisition, organization and processing of information in the conduct of business, industrial or government activities. Its core has traditionally been in accounting and control activities. Existing MIS are primarily batch oriented with the files organized sequentially, specially arranged for each processing run. In advanced MIS the data bases will be integrated to contain all the information, with minimum redundance, and transactions will be processed through accessing the data on a random access basis. Author

N71-37750# Netherlands Postal and Telecommunications Service, The Hague.
AUTOMATIC READING OF HANDWRITTEN HEBREW
A. J. van der Toorn *In* Inform. Process. Assoc. of Israel Proc. of the Natl. Conf. on Data Process. 1970 p E111-E126 refs (See N71-37742 24-08)
Avail: NTIS HC $6.00/MF $0.95

The automate reading of handwritten Hebrew is based on the application of horizontal 10-position marking-grids in which not only numerals but also letters with their subsigns can be filled in according to easy rules and with good visual readability. Author

N71-37751# California Univ., Livermore. Lawrence Radiation Lab.
COMPUTER GRAPHICS APPLICATION TO COMPUTER-AIDED PRINTED CIRCUIT DESIGN
Waldo G. Magnuson, Jr. Dec. 1970 4 p refs Presented at the 4th Intern. Conf. on Systems Sci., Honolulu, Hawaii, 12-14 Jan. 1971 Sponsored by AEC
(UCRL-72637; Conf-710110-2) Avail: NTIS

Summarized is a technique that uses a computer graphics system for assisting in the design of printed circuit (PC) cards. In particular, the preliminary design of a graphics applications program which permits the on-line, interactive specification of a PC card is described. Author (NSA)

N71-37752# California Univ., Livermore. Lawrence Radiation Lab.
HAL1903: DIGITAL LOGIC SIMULATOR
John K. Lum, Jr. Dec. 1970 4 p Presented at the 4th Intern. Conf. on Systems Sci., Honolulu, Hawaii, 12-14 Jan. 1971 Sponsored by AEC
(UCRL-72694; Conf-710110-1) Avail: NTIS

HAL1903 is a digital logic simulation program. A user simulates a logic circuit by describing circuit topology as a list of integrated circuits used and wired connections between. Simulation results are a 20-trace oscilloscope-like plot and a list of where and when certain signal transitions and transients occurred. This hardware oriented program is aimed at aiding logic designers in the design and debugging of digital logic circuits. Author (NSA)

N71-37753# Illinois Univ., Urbana. Dept. of Computer Science.
SHOW AND TELL: AN INTERACTIVE PROGRAMMING SYSTEM FOR IMAGE PROCESSING: SYSTEM SPECIFICATIONS
John Read 18 Feb. 1971 56 p refs
(Contract AT(11-1)-2118)
(COO-2118-3; Rept-429) Avail: NTIS

The show-and-tell programming system, a console-oriented software package providing a facile method of using the operational components of the Illiac 3 computer is described. The system is designed to support two different types of programming objectives corresponding to a well-known decomposition of image processing into two phases: a preprocessing and feature-extraction phase followed by an interpretation phase. Show-and-tell's design provides facilities for the manual control of scanning hardware so that preprocessing routines can be tried out on a large number of test images. A link is provided to the IBM 360/75 with its large amounts of storage and high-level programming languages so that phase 2's interpretation routines can be coded with a minimum of wasted effort and time. The link is bidirectional, in that interpretation programs written in a high-level language (FORTRAN/PAX) can provide feedback to the acquisition and preprocessing of phase 1. Author

N71-37754# Illinois Univ., Urbana. Dept. of Computer Science.
INTERVAL GENERALIZATION OF SWITCHING THEORY
R. S. Michalski and B. H. McCormick 3 May 1971 18 p refs
(Contract AT(11-1)-2118)
(COO-2118-8; Rept-442) Avail: NTIS

The concept of ordered covers was developed to accomodate a preferential order in covering the set of mixed events. The synthesis algorithm of covers is based on the 'method of disjoint stars', which has proved to be very useful for synthesis of complex switching systems. Quasi-minimal covers, produced by this method, are either minimal or approximately minimal. Applications of the interval coverings concepts to pattern recognition and picture filtering are delineated. Author

N71-37755# Joint Publications Research Service, Washington, D.C.
COMPUTER ANALYSIS AND MATHEMATICAL MODELING
1 Oct. 1971 25 p refs Transl. into ENGLISH from Ekon. i Mat. Metody (Moscow), v. 5, no. 1, 1969 p 63-72 and 153-157
(JPRS-54168) Avail: NTIS

CONTENTS:
1. COMPUTER ANALYSIS OF BUSINESS GAMES V. V. Kolbin et al p 1-15 refs (See N71-37756 24-08)
2. MATHEMATICAL MODELS OF PLANNING AND CONTROL OF SCIENTIFIC RESEARCH F. G. Gurvich p 16-24 refs (See N71-37757 24-19)

N71-37756# Joint Publications Research Service, Washington, D.C.
COMPUTER ANALYSIS OF BUSINESS GAMES
V. V. Kolbin et al *In its* Computer Analysis and Mathematical Modeling 1 Oct. 1971 p 1-15 refs (See N71-37755 24-08)
Avail: NTIS

A complex computerized game for training a group of business students in decision making and cooperation is described. The students are accustomed to analyzing available information, holding conferences, organizational experience, and decision making under conditions of risk and indeterminancy. The game complex is represented by the extracting industry, the processing industry, and the industry producing national consumer goods, plus a bank and a board of arbitrators. Each industry is subdivided into three specialties, and four games with different conditions are described. Instructions for the participants and the sequence of operations are outlined, and the problem of stochastic linear programming is discussed. N.E.N.

N71-37757# Joint Publications Research Service, Washington, D.C.
MATHEMATICAL MODELS OF PLANNING AND CONTROL

OF SCIENTIFIC RESEARCH e19
F. G. Gurvich *In its* Computer Analysis and Mathematical Modeling 1 Oct. 1971 p 16-24 refs (See N71-37755 24-08)
Avail: NTIS

Dynamic mathematical models of integral linear programing are discussed for the optimal development of applied scientific research. The problem considers individual research organizations and individual branches of research. Each organization can work in one or several fields of research, and each division of scientific research is characterized by definite expenditures of limited resources, expenditures of ideas or procedures, and production of a defined new idea or set of ideas, procedures, technology, and materials. A defined technical or social result such as improved labor or safety conditions is included, along with estimates of effectiveness of each of several possible versions. N.E.N.

N71-37758# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ELECTRONIC COMPUTERS AND ANALOG DEVICES
V. I. Grubov et al 23 Feb. 1971 267 p refs Transl. into ENGLISH of the "Elektronnye Vychislitelnye Mashiny i Modeliruyushchiye Ustroistva" Kiev, Naukova Dumka, 1969 p 1-184
(AD-727262; FTD-HC-23-457-70) Avail: NTIS CSCL 09/2

The handbook presents a classification of electronic and analog computers and analog devices, including descriptions, basic technical features and fields of application of domestically-manufactured universal digital computers, digital control devices, digital specialized machines, analog devices for general purposes, and analog specialized devices. Author (GRA)

N71-37759# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CAPABILITIES OF ELECTRONIC COMPUTERS OF THE MINSK AND URAL TYPE WHEN USED IN CONTROL SYSTEMS
N. G. Zaitsev et al 19 Mar. 1971 12 p Transl. into ENGLISH from Mekhanizatsiya i Avtomatizatsiya Upravleniya (USSR), no. 4, 1968 p 29-32
(AD-727265; FTD-HT-23-235-71) Avail: NTIS CSCL 09/2

The authors discuss the new method of synthesizing dispersion-strengthened compositions (pseudoalloys) p heterogeneous structures synthesized from nonalloying components, where the dispersion phases serve as the component which regulates and optimizes the properties of the matrix medium. Damping of dislocations by dispersion particles of such components discussed and equations given. Author (GRA)

N71-37760# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CYBERNETICS AND TRANSPORTATION. CYBERNETICS IN PLANNING, DESIGN AND CONTROL OF RAILROAD TRANSPORTATION (SELECTED ARTICLES)
V. F. Grin et al 26 Feb. 1971 8 p refs Transl. into ENGLISH from the publ. "Kibernetika i Transport. Kibernetika v Proyektirovanii i Upravlenii na Zheleznodorozhnom Transport" Moscow, Nauka, 1968 p 101-117
(AD-727267; FTD-MT-24-241-70) Avail: NTIS CSCL 13/2

Selected articles devoted to the application of mathematical methods and computers for automation of controls for operation and engineering design in single-track rail transportation are presented. Automation of the operation of large railroad stations and the solution of complex problems of designing units for electrical centralization of switches and signals are emphasized. Author

N71-37761# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE PROBLEM OF RELIABILITY OF AUTOMATICALLY DESIGNED COMPUTERS. 1
Yu. G. Sevchenko et al 30 Mar. 1971 27 p refs Transl. into ENGLISH from Tr. Teoriya Avtomatov i Metody Formalizovannogo Sinteza Vychislitelnyth Mashin i Sistem Seminar (Kiev), no. 3, 1968 p 83-104
(AD-727234; FTD-MT-24-10-71) Avail: NTIS CSCL 09/2

The paper is devoted to the subject of reliable synthesis in automatic designing of digital machines according to methods being developed by the Department of Computer Theory of the Institute of Cybernetics of the Academy of Sciences of the Ukrainian SSR. It consists of two parts. The first containing a statement of the problem and a survey of structural and informational methods of introducing redundancy. The second part contains specific recommendations for using methods of redundancy. Those methods which are dealt with in detail are the Neumann and the Moore-Shannon method. Author (GRA)

N71-37762# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
OPERATIONAL RELIABILITY OF DIGITAL COMPUTERS
V. A. Vasilenko 29 Jan. 1971 12 p Transl. into ENGLISH from Mekhaniz. Avtomatiz. Proizv. (USSR), no. 12, 1969 p 37-38
(AD-727163; FTD-HT-23-16-71) Avail: NTIS CSCL 09/2

The article deals with means for increasing the operating reliability of digital computers used in automatic control systems. This is done by maintaining the level of computer reliability in operation, as well as in taking measures for efficient operation of the computer and in exercising the proper preventive maintainance. Author (GRA)

N71-37763# Stanford Univ., Calif. Electronics Labs.
DYNAMIC MEMORIES WITH ENHANCED DATA ACCESS
Harold S. Stone Feb. 1971 33 p refs
(Contract N00014-67-A-0112-0044)
(AD-727116; SU-SEL-71-009; TR-14; STAN-CS-71-220) Avail: NTIS CSCL 09/2

Dynamic memories are commonly constructed as circulating shift registers, and thus have access times that are proportional to the size of the memory. When each word in a dynamic memory is connected to r words, $r > or = 2$, access time can be proportional to the base r logarithm of the size of memory. A memory is described that achieves minimum access time for $r = 2$. The memory can also be operated in an efficient binary search mode. Slight variations of the interconnection patterns lead to a memory that is well suited for FFT and certain matrix computations. Author (GRA)

N71-37764# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
MINIATURE COMPUTERS
S. A. Mayorov et al 7 May 1971 158 p refs Transl. into ENGLISH from monograph "Malogaberitnye Vychislitelnye Mashiny" (Small Computers) Moscow, 1967 p 20-41, 71-77, 80-96, 108-139, 142-208, 232-234
(AD-727190; FTD-HC-23-842-70) Avail: NTIS CSCL 09/2

The design of digital control systems, starting with determination of control strategy up to testing the system prototype has been associated with finding an optimal solution at each stage of the design which will satisfy constraints for accuracy, operating speed, structural simplicity and reliability. The tendency to exclude the possibility of introducing errors and to increase the designer's working efficiency in the process of designing leads to the necessity of extensive use of general-purpose digital computers (GPDC) for solving problems of qualitative determination of the required control system parameters, analysis of functions and the diagrams of the proposed system configurations, and compiling technical and technological documentation. Author (GRA)

N71-37765# Naval Air Systems Command, Washington, D.C.
ADVANCED AVIONIC DIGITAL COMPUTER DEVELOPMENT PROGRAM Progress Report
Ronald S. Entner 1 Jul. 1971 108 p refs

(AD-727607; PR-8) Avail: NTIS CSCL 09/2

The report contains the following: Preliminary statement of work for an analytical study to establish the feasibility of a tactical interactive programming facility; Summary sheets of AADC program review; Papers entitled, the programmer as a computer designer; AADC status report; Storage technology and advanced computer architecture; Agenda of the advanced digital technology conference. GRA

N71-37766# Naval Air Systems Command, Washington, D.C.
ADVANCED AVIONIC DIGITAL COMPUTER DEVELOPMENT PROGRAM Progress Report
Ronald S. Entner 4 Feb. 1971 52 p refs
(AD-727605; PR-7) Avail: NTIS CSCL 09/2

Contents: AADC bibliography; Preliminary statement of work for a high level programming language development; On software modularity. GRA

N71-37767# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PRINCIPLES OF DESIGNING INFORMATION CONVERTERS THAT OPERATE IN A SYSTEM OF RESIDUAL CLASSES
I. T. Abramson et al 12 Jun. 1971 18 p refs Transl. into ENGLISH from Avtometriya (USSR), no. 2, 1969 p 3-10
(AD-727970; FTD-MT-24-11-71) Avail: NTIS CSCL 09/2

The report discusses the designing of analog-digital converters which operate directly with a system of residual classes, without intermediate conversion into a position system of numeration. Author (GRA)

N71-37768# Air Force Systems Command, Wright-Patterson AFB, Ohio.
A METHOD FOR FINDING THE FUNCTIONAL DIAGRAM OF A COMBINATION AUTOMATON WITH THE APPEARANCE OF A COMPLEX OF FAULTS
A. N. Sidyarevich 27 May 1971 19 p refs Transl. into ENGLISH from Avtomat. Vyhisl. Tekh. (Riga), no. 5, 1969 p 30-36
(AD-727974; FTD-MT-24-58-71) Avail: NTIS CSCL 09/2

A method is considered for finding the functional diagram of a combination automaton which developed a complex of faults. The operators are inputs which characterize the faults of primary logic elements, and rules of converting the logic diagrams containing such operators are proposed. Examples are given which use the procedure being recommended. Author (GRA)

N71-37769# Air Force Systems Command, Wright-Patterson AFB, Ohio.
THE OPTIMUM SYNTHESIS OF LOGIC CIRCUITS USING OR-NOT ELEMENTS
S. V. Novikov 28 May 1971 24 p refs Transl. into ENGLISH from Tr. Seminar Teoriya Avtomat. i Metody Formalizovannogo Sinteza Vychisl. Mashin i Sistem (Kiev), no. 3, 1968 p 58-74
(AD-727972; FTD-MT-24-20-71) Avail: NTIS CSCL 09/2

Several universal algorithms which permit synthesizing logic circuits are known. Boolean-function circuits depending on not more than three variables can be synthesized. Author (GRA)

N71-37770# California Univ., Los Angeles. Dept. of Computer Science.
COMPUTER NETWORK RESEARCH Semiannual Technical Report, 15 Aug. 1970 - 30 Jun. 1971
Leonard Kleinrock, Gerald Estrin, Michel Melkanoff, and Richard R. Muntz 30 Jun. 1971 137 p refs
(Contract DAHC15-69-C-0285; ARPA Order 1388)
(AD-727969) Avail: NTIS CSCL 09/2

The goal of this project is to provide an environment for high quality research activities in information processing. One major area of research is mathematical modeling and analysis of computer systems. Another principle area of research, which is closely coupled with the first, is measurement of computer systems. Activity has been directed toward the analysis and measurement of time-shared systems and the ARPA computer communication network. Our third major area of responsibility has been in the specification of software protocol for use in the network. Author (GRA)

N71-37771# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
AUTOMATION OF THE MENTAL WORK IN MACHINE BUILDING
A. I. Berg et al 13 May 1971 56 p refs Transl. into ENGLISH from the monograph "Avtomatizatsiya Umstvefnogo Truda v Mashinostroenii" Moscow, 1969 p 5-39
(AD-727890; FTD-MT-24-346-70) Avail: NTIS CSCL 09/2

This work deals with the use of computers to perform mental tasks formerly performed by human beings, in particular designing machines. Author (GRA)

N71-37772# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CONVERSION OF SEVERAL COMPUTATIONAL ALGORITHMS FOR DECREASING THE LENGTH OF THE WORD FORM AT OF CONTROL COMPUTERS FOR AIRCRAFT
I. N. Kornet et al 3 Mar. 1971 9 p Transl. into ENGLISH from Samoletostr. Tekhk. Vozdush. Flota (USSR), no. 14, 1969 p 21-24
(AD-727917; FTD-HC-23-865-70) Avail: NTIS CSCL 09/2

The report discusses the transformation of certain computational algorithms to a form convenient for computer adaptation. It is shown that, by reducing an algorithm to a form that makes it possible to obtain the values of a function from its increments, the length of the digital network of the computer can be shortened with a very small accuracy penalty. This is of particular importance in the case of aircraft computers, as it simplifies their structure and reduces the speed requirements. Author (GRA)

N71-37773# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
AN IMAGE INPUT AND OUTPUT UNIT FOR THE MINSK-2 COMPUTER
M. M. Binder et al 22 Mar. 1971 8 p Transl. into ENGLISH from Akad. Nauk SSSR Inst. Probl. Peredachi Inform. (USSR), 1968 p 94-96
(AD-727946; FTD-HT-23-116-71) Avail: NTIS CSCL 09/2

A description is given of an image input and output unit for the MINSK-2 computer developed for the study of the statistical characteristics of images, for the simulation of various transmission techniques, and for the statistical filtration of half-tone and black and white images. Author (GRA)

N71-37774# Royal Aircraft Establishment, Farnborough (England).
TUT-3: A COMPUTER PROGRAM FOR SIMULATING THE ATTACK OF LOW FLYING AIRCRAFT BY ANTI-AIRCRAFT MISSILES [MASKINPROGRAM FOER SIMULERING AV LV-ROBOT MOT LAGT FLYGANDE FLYPAN]
J. Palme et al May 1971 17 p refs Transl. into ENGLISH from FOA-P rept., C 8183-13, 1968
(RAE-Lib-Trans-1578) Avail: NTIS

Intervisibility distances are distances along the aircraft's flight course where there exists alternately a line of sight and no line of sight. The means by which these distances are obtained are described in a separate report. The computer program to be described in this paper uses these intervisibility distances, obtaining them either from magnetic tape, or alternately generating them from a built in Monte Carlo type subroutine. TUT-3 computer program simulates an anti-aircraft defence with the aircraft flying along a course divided into intervisibility distances. Results are given in the form of average number of engagements

per shot. In the simulation, the aircraft is assumed to be flying at constant speed along a straight-line course. The missile is assumed to fly on an intercept path, i.e. towards a point ahead of the aircraft. The missile acceleration can if necessary be varied in the time of flight. The time for a relaunch after an interception, or after a line of sight interruption may be fed in as a constant or as a probability with some time distribution.
Author

N71-37775*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COMPUTER PROGRAM FOR CALCULATION OF COMPLEX CHEMICAL EQUILIBRIUM COMPOSITIONS, ROCKET PERFORMANCE, INCIDENT AND REFLECTED SHOCKS, AND CHAPMAN-JOUGUET DETONATIONS
Sanford Gordon and Bonnie J. McBride Washington 1971 250 p refs
(NASA-SP-273) Avail: NTIS CSCL 09B

A detailed description of the equations and computer program for computations involving chemical equilibria in complex systems is given. A free energy minimization technique is used. The program permits calculations such as: (1) chemical equilibria for assigned thermodynamic states (T,P), (H,P), (S,P), (T,V), (U,V), or (S,V); (2) theoretical rocket performance for both equilibrium and frozen compositions during expansion; (3) incident and reflected shock properties; and (4) Chapman-Jouguet detonation properties. The program considers condensed species as well as gaseous species.
Author

N71-37776*# Environmental Protection Agency, Research Triangle Park, N.C.
USERS MANUAL: SAROAD (STORAGE AND RETRIEVAL OF AEROMETRIC DATA)
Jul. 1971 67 p
(APTD-0663) Avail: NTIS

The standard methods of handling air quality and related meteorological data to facilitate the exchange of technical information needed for air pollution abatement, control, and research are discussed. The user's manual informs state and local air pollution control agencies how to include their data in the National Aerometric Data Bank. These forms include punched cards, magnetic tapes, and paper forms all in SAROAD (storage and retrieval of aerometric data) format. Each form and its use are discussed in detail along with any improvements made in the forms.
E.H.W.

N71-37777*# Computer Sciences Corp., Huntsville, Ala. Field Services Div.
SPACEBORNE COMPUTER EXECUTIVE ROUTINE FUNCTIONAL DESIGN SPECIFICATION. VOLUME 3: EXECUTIVE ROUTINE PRIMITIVES AND PROCESS CONTROL
James R. Kennedy, Sr. Washington Oct. 1971 95 p refs
(Contract NASS-24930)
(NASA-CR-1869) Avail: NTIS CSCL 09B

The concept of a process is discussed. The process state transitions activated by application program usage of system primitives are formalized. Approaches for implementing the required control capabilities in both software (the traditional approach) and digital hardware logic are detailed. Logic network and control sequencing requirements are derived, and the associated circuit diagrams are shown. Software procedures for performing a similar function are developed and depicted in an ALGOL-like source program form. A brief comparison of the two approaches is made.
Author

N71-38628# National Research Council of Canada, Ottawa (Ontario). Control Systems Lab.
EXPERIMENTS WITH AN ON-LINE PICTURE LANGUAGE
T. Kasvand *In its* Quart. Bull. of the Div. of Mech. Eng. and the Nat. Aeron. Estab., 1 Apr. - 30 Jun. 1971 Jun. 1971 p 21-56 refs (See N71-38626 24-30)
Avail: NTIS

N71-37668# Joint Publications Research Service, Washington, D.C.
MATRIX METHOD OF REPRESENTING OPERATIVE DATA
Yu. A. Ivashkin *In its* Man in Control Systems 1 Oct. 1971 p 21-25 refs (See N71-37664 24-05)
Avail: NTIS

N71-37669# Joint Publications Research Service, Washington, D.C.
METHOD AND DEVICE FOR THREE-DIMENSIONAL REPRESENTATION OF INFORMATION
G. P. Katys et al *In its* Man in Control Systems 1 Oct. 1971 p 26-30 refs (See N71-37664 24-05)
Avail: NTIS

N71-37671# Joint Publications Research Service, Washington, D.C.
PROBLEM OF EVALUATING THE ACTIVITY OF A GROUP OF OSCILLATORS IN CONTROL SYSTEMS
Yu. A. Golant *In its* Man in Control Systems 1 Oct. 1971 p 37-43 (See N71-37664 24-05)
Avail: NTIS

09 ELECTRONIC EQUIPMENT

Includes electronic test equipment and maintainability; component parts, e.g., electron tubes, tunnel diodes, transistors; integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications and 21 Navigation.

N71-37778# Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.
NANOSECOND PULSE AMPLIFIER WITH AN ADJUSTABLE GAIN, WORKING IN BOTH POLARITIES [AMPLIFICATEUR NANOSECONDE A GAIN REGLABLE FONCTIONNANT DANS LES DEUX POLARITIES]
A. Lavaitte Mar. 1971 4 p ref In FRENCH; ENGLISH summary
(CEA-N-1439) Avail: AEC Depository Libraries

A noninverter amplifier admitting positive and negative pulses is described. Its gain is continuously adjustable from 10 to 1,000 and its rise and fall time is 3 ns.
Author (NSA)

N71-37779# Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.
BROAD BANDWIDTH DIFFERENTIAL AMPLIFIER [AMPLIFICATEUR DIFFERENTIEL A GRANDE BANDE PASSANTE]
A. Lavaitte Apr. 1971 7 p In FRENCH; ENGLISH summary
(CEA-N-1448) Avail: AEC Depository Libraries

A differential amplifier having a gain of 16 from dc to 150 MHz is presented. The rise and fall times are equal to 2 ns, the linearity is better than 1% and a high stability is obtained by using a dc feedback system.
Author (NSA)

N71-37780# Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.
THE 200 MHz PULSE AMPLITUDE DISCRIMINATOR [DISCRIMINATEUR D'AMPLITUDE 200 MHZ]
G. Sentis and R. Van Zurk Mar. 1971 7 p refs In FRENCH; ENGLISH summary
(CEA-N-1447) Avail: AEC Depository Libraries

A fast dc coupled discriminator is described. Its threshold is continuously adjustable from 50 to 500 mV with an hysteresis of 50 mV and a stability better than 0.4 mV/ C. Its resolving time is 5 ns. Two 1 V complementary output signals are

available with a common width adjustable by short circuited coaxial cable down to 2 ns. Author (NSA)

N71-37781*# Georgia Inst. of Tech., Atlanta. Electronics Div.
SPACE VEHICLE ELECTRICAL POWER SYSTEMS STUDY Final Technical Report
S. L. Robinette, G. W. Bechtold, and G. W. Spann 22 Sep. 1971 59 p refs
(Contract NAS8-25192; Project A-1251)
(NASA-CR-119961) Avail: NTIS CSCL 09D

A survey of literature on advanced electrical power systems of aircraft, ships, and other vehicles was conducted in conjuction with developing suitable solid-state controllers for spacecraft power distribution systems. The trend in aircraft power system technology is toward higher voltages in order to reduce cable weight distribution; but corons and flashover conditions will restrict the maximum voltage permissible in spacecraft environments. To meet the criteria of reliability and maintainability, a control system for power distribution (data bus) with self-check capability is recommended. E.M.C.

N71-37782*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
FLAT CONDUCTOR CABLE CONNECTOR SURVEY OF 1970
W. Angele, Hans G. Martineck, J. D. Bennight, and James D. Hankins Jul. 1971 305 p
(NASA-TM-X-64613) Avail: NTIS HC $6.00/MF $0.95 CSCL 09A

Commercial and government flat conductor cable is illustrated for connecting and terminating hardware. The various uses of the flat and round connectors and receptors are presented in tabular form. J.A.M.

N71-37783# Army Mobility Equipment Research and Development Center, Fort Belvoir, Va.
CONFERENCE PROCEEDINGS: COMPONENT DEGRADATION FROM TRANSIENT INPUTS
1 Jul. 1971 306 p refs Conf. held at Fort Belvoir, Va., 28-29 Apr. 1970
(AD-726923) Avail: NTIS HC $6.00/0.95 CSCL 09/1

The proceedings of the conference on 'Component Degradation From Transient Inputs' is presented. The papers given cover the effects of induced electrical transients, as produced by an Electromagnetic Pulse on electronic components. Attention is focused on electrical stress degradation and damage on semiconductors. Topics such as thermal damage models, multiple damage mechanisms, effects of complex waveshapes, synergistic effects, effects on integrated circuitry, and the statistics involved in the characterization of failure are discussed. Author (GRA)

N71-37784# Princeton Univ., N.J. Dept. of Electrical Engineering.
EFFECT OF COEFFICIENT ROUNDING IN FLOATING POINT DIGITAL FILTERS
Toyohisa Kaneko and Bede Liu Jul. 1971 28 p refs
(Grant AF-AFOSR-1333-67)
(AD-727073; AFOSR-71-2045TR) Avail: NTIS CSCL 09/5

The paper analyzes the effect of coefficient rounding in digital filters using floating-point arithmetic. An error is defined as the difference between the output of a digital filter realized with a finite number of bits and the output of the same filter using infinite number of bits. It is shown that this error consists of two uncorrelated components. One component is due to the rounding of the arithmetic operations alone, and the other component represents the additional error due to coefficient rounding. Expressions are derived for the mean square value of the error for the three canonical programming forms. The stability problem is studied by examining the shift of the pole locations due to the coefficient rounding. Mean square value of the shift is calculated. Good agreement between the theoretical and experimental results are obtained. Author (GRA)

N71-37785# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
A MULTITHRESHOLD LOGIC ELEMENT
V. I. Davydov 9 Apr. 1971 10 p refs Transl. into ENGLISH from Avtomat. Vychisl. Mekh. (USSR), no. 4, 1969 p 94-96
(AD-727437; FTD-HT-23-115-71) Avail: NTIS CSCL 09/2

A two-threshold transistor circuit is used as a basis for a design for a four-threshold logical element. The circuit details and experimental characteristics of a device suitable for practical use are given. Author (GRA)

N71-37786# Air Force Contract Management Div., Los Angeles, Calif. Directorate of Quality Assurance.
INTEGRATED CIRCUIT REPORT Final Report
Thomas A. Hollingworth and Aldo F. Loria Jan. 1971 56 p
(AD-726560; AFCMD-TR-71-01; AFCMD/QA-153) Avail: NTIS CSCL 09/5

An evaluation was accomplished of the design, fabrication, inspection and testing of integrated circuits (ICs) as practiced by the electronics industry. An analysis was made of failure modes and causes of failure. The purpose was to disseminate information on current IC technology to AFSC Quality Assurance personnel. A corollary purpose was to improve the quality and reliability of hardware using these devices. Author (GRA)

N71-37787# Stanford Univ., Calif. Electronics Labs.
THEORY AND PERFORMANCE OF N-PATH FILTERS
Allston L. Jones May 1971 79 p refs
(Contract N00014-67-A-0112-0044)
(AD-727140; SU-SEL-71-026; TR-3602-1) Avail: NTIS CSCL 09/5

The paper has five major sections. In the first, the periodic time varying network with N-identical paths operating between modulators is examined theoretically by the use of Laplace transforms. The transfer function is derived generally and then expanded for sinusoidal and rectangular modulation. In both cases the low-pass to band-pass characteristic is retained assuming low-pass elements in each path. The next section investigates theoretically, the effects of using other than low-pass elements in the N-paths. The results are such that, if a high-pass, first order all-pass, or a simple band-pass are used in the N-paths the resultant transfer function became a variable attenuator, a notch filter or a pair of adjacent band-pass filters respectively. The third major area is that of switching variations. A more practically oriented configuration is introduced, its transfer function variations are determined and then parallel switching is discussed. In the last sections, the real world tolerances and other variations of the components are accounted for in the transfer function of the N-path filter and their effects are noted in five disturbance categories, most serious of which are the variations in the modulating waveforms. Then finally there is a detailed implementation of an N-path filter for use in an IF of an AM/FM receiver which was introduced earlier in the literature. This application makes use of electronic bandwidth and frequency variations. Author (GRA)

N71-37788# California Univ., Los Angeles. School of Engineering and Applied Science.
INTERFACE PHENOMENA IN INTEGRATED CIRCUIT OXIDES Semiannual Report, 30 Jun. - 29 Dec. 1970
Cadambanguidi R. Viswanathan May 1971 26 p refs
(Contract DAAB07-70-C-0283)
(AD-727693; ECOM-0283-1; SAR-1) Avail: NTIS CSCL 09/1

The instability in MIS devices, arising due to mobile positive ions in the insulator layer was investigated experimentally and theoretically. When ions move from one interface to another of a metal-oxide-silicon structure under the action of an external field at an elevated temperature, the charge induced in the silicon electrode and in the metal electrode changes and a current flows through the external circuit. Measurement of the charge flow indicates that the rate of ion transport is excitation limited rather than diffusion limited as previously assumed by other researchers. An investigation of the luminescence during anodic oxidation of

silicon was started. The emitted light is detected by a photomultiplier and spectral curves obtained by use of eighteen interference filters. The effect of charge induced in MOS structures by ionizing radiation is being studied by photoelectric techniques and focus will be on annealing effects. Author (GRA)

N71-37789# Purdue Research Foundation, Lafayette, Ind.
CONDUCTION MECHANISMS IN THICK FILM MICROCIRCUITS Semiannual Technical Report, 1 Jan. - 30 Jun. 1971
R. W. Vest 1 Aug. 1971 54 p refs
(Contract DAHC15-70-G-7; ARPA Order 1642)
(AD-727868) Avail: NTIS CSCL 09/1

Specifications were developed to define good resistors and conductors for the project. The design and performance of a laboratory scale three roll dispersing mill is described. The contact resistance between two single crystals of RuO2 in the presence of glass was measured as a function of temperature and thermal history. After formation of a stable contact during the first firing, the contact resistance was observed to be large compared to the crystal resistance, to have a lower TCR, and to increase with repeated firings; models are proposed to explain these results. The coefficient of linear thermal expansion was measured for alloys in the Ag-Pd and Au-Pt systems; the results were correlated with the respective phase diagrams.
Author (GRA)

N71-37790# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
MAGNETIC THYRISTOR LOGICAL ELEMENTS
V. A. Gorokhov et al 30 Mar. 1971 15 p refs Transl. into ENGLISH from Avtomat. Vychisl. Tekh. (Riga), no. 6, 1969 p 82-86
(AD-727192; FTD-HC-23-41-71) Avail: NTIS CSCL 09/2

A discussion of the elements of the title and their applications in logic circuits is given. The elements consist of thyristors blocked by control electrodes, and magnetic cores with rectangular hysteresis loops. Because of the high pulse load of the thyristors and their characteristic internal memory, they are free from the weaknesses of magnetic diodes and transistors. The schematics of several possible circuits using these elements are considered, and the operation of those circuits is explained. A listing is given of the requirements of blocking thyristors used in logic circuits. The data afforded by the authors: preliminary researches and analyses of the thyristor parameters show that the magnetic thyristor logic elements have the following advantages: ease of miniaturization; simple indications of the state of the elements are possible; nondestructive readings; control power required is less than that for transistors, and the load capacity is greater; hence these elements offer possibilities of microminiaturization in the form of hybrid circuits.
Author (GRA)

N71-37791# Naval Underwater Systems Center, Newport, R.I. Communication Dept.
AN INVESTIGATION OF THE DIPOLE ANTENNA OVER STATIONARY AND TIME-VARYING IRREGULAR SURFACES
Dennis E. Fessenden (Ph.D. Thesis - R.I. Univ.) 10 Jun. 1971 124 p refs
(AD-728033; NUSC-4093) Avail: NTIS CSCL 09/5

Investigations of electromagnetic scattering from rough surfaces have been oriented toward radar surveillance or remote sensing applications. An important problem that has been relatively unexplored is that of a dipole antenna close to and illuminating an ocean surface with spherical waves, for example, communication antennas on submarines or surface ships. The work is concerned primarily with the fluctuations in the far electric field intensity caused by reinforcement and cancellation of the direct wave by the wave reflected from a time-varying surface. The analysis starts with the simplest possible model of a time-varying surface. A vertical electric dipole is situated above a flat ground that varies sinusoidally about a fixed reference plane. Other simple models are considered, one of which shows that depolarization is introduced. The most sophisticated model of the ocean surface that is considered is one for a moving sinusoidal surface. Certain situations arise so that the sinusoidal model is a good approximation of an actual ocean surface. For the sinusoidal ocean surface model, the amplitude of the sine curve is small compared with a free-space wavelength; therefore, a Fourier integral-perturbation series approach can be used to solve the boundary value problem.
Author (GRA)

N71-37792# Westinghouse Research Labs., Pittsburgh, Pa. Astronuclear Lab.
HIGH TEMPERATURE ELECTRONICS Final Technical Report, 11 Nov. 1968 - 15 May 1971
R. B. Campbell, H. S. Berman, W. D. Loftus, and C. E. Hardiee Jul. 1971 80 p refs
(Contract F33615-70-C-1063)
(AD-727761; AFAPL-TR-71-46) Avail: NTIS CSCL 09/5

The fabrication of a silicon carbide (SiC) junction field effect transistor (J-FET) was shown practicable. Several amplifier designs were breadboarded with silicon devices to study the required parameters. A simplified building block amplifier was constructed and tested.
Author (GRA)

N71-37793# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PHOTOELECTRIC IMAGE CONVERTERS WITH OPTICAL COMMUTATION
V. P. Golovikhine et al 11 Mar. 1970 10 p refs Transl. into ENGLISH from Tekhn. Kino Televideniya (USSR), v. 14, no. 3, 1970 p 54-55
(AD-727880; FTD-MT-24-335-70) Avail: NTIS CSCL 09/1

Comparison is made between photoelectrical image converters of different designs.
Author (GRA)

N71-37794# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
A STUDY OF THE SIGNAL-NOISE RATIO OF A PHOTOMULTIPLIER
V. S. Gdalin et al 13 Mar. 1971 12 p refs Transl. into ENGLISH from Tekhn. Kino i Televideniya (USSR), v. 14, no. 4, 1970 p 64-65
(AD-727878; FTD-MT-24-329-70) Avail: NTIS CSCL 09/1

Discussed are dependences of signal-to-noise ratio of photoelectronic multipliers working in the flying spot system from electrical, light and thermal working regimes. Investigated is the influence of vacuum on the signal-to-noise ratio of photoelectronic multiplier. Given are recommendations for exploitation conditions of photoelectronic multiplier in the flying spot system to assure its optimum signal-to-noise ratio. GRA

N71-37795# Naval Civil Engineering Lab., Port Hueneme, Calif.
AN ENERGY INJECTION CIRCUIT FOR ac POWER CONTINUITY DEVICE Technical Note, Jul. 1969 - Jun. 1970
K. T. Husng Jun. 1971 31 p ref
(AD-727561; NCEL-TN-1163) Avail: NTIS CSCL 09/5

NCEL previously investigated the use of an L-C tank circuit as a redundant power source for supplying continuous power during momentary interruptions of the primary power source, lasting 100 milliseconds or less (See AD-716409). Results of this investigation showed that the tank circuit has an inherently high power loss. Further, the amount of energy that can be stored in the tank circuit is limited by the physical size of the tank circuit components. In an effort to reduce the size of the tank circuit components, an energy injection circuit was investigated. An experimental, 1 KW, 100 volt, 60 Hz model of the circuit was developed and evaluated by NCEL. The model consisted of a source disconnect switch, tuned L-C series circuit, an L-C tank circuit, and logic circuits. Two advantages of the energy injection circuit were noted as a result of Laboratory tests. (1) The size of the L-C tank circuit components can be

optimized by supplementing the stored energy requirements with a redundant DC power source provided with the energy injection circuit, and (2) the power output could be sustained for longer periods during interruptions of the normal power sources, limited only by the capacity of the DC power source in the injection circuit. It was concluded that the energy injection circuit can only be considered as a low level power continuity device for loads of less than 50 KVA. Author (GRA)

N71-37796# Tokyo Univ. (Japan). Inst. of Industrial Science.
ON THE OPERATING CHARACTERISTICS OF TWO-PHASE SERVOMOTORS AND DRIVING CIRCUITS
Fumio Harashima and Zenzaburo Sawai Jun. 1971 68 p refs
Its Rept. of the Inst. of Ind. Sci., Vol. 21, No. 2
Avail: NTIS

The operating characteristics of two-phase servomotors with their driving circuits are discussed and new types of servo amplifier which make use of switching devices are proposed. Equations of two-phase servomotors and servo amplifiers are presented. Analytical methods and simulation techniques to obtain two-phase servomotor characteristics are shown. Advantages and disadvantages of the methods are described. Author

N71-37797# Grumman Aerospace Corp., Bethpage, N.Y. Life Sciences Section.
A SWITCHING TYPE POWER SUPPLY FOR BIDIRECTIONAL dc MOTOR CONTROL
Martin Kesselman Oct. 1971 18 p refs
(RM-521) Avail: NTIS

A motor controller utilizing pulse width modulation techniques was developed to vary the output of a 24 V dc permanent magnet motor smoothly from full forward to full reverse in proportion to command signals from a control potentiometer. The controller can deliver up to 120 A, provides smooth output, and incorporates a negative hysteresis circuit for canceling the effects of friction in the mechanical system driven by the motor. Author

N71-37798 Purdue Univ., Lafayette, Ind.
AN INVESTIGATION OF THE TRANSIENT RESPONSE OF SEMICONDUCTOR JUNCTION DIODES
William Edison Drobish (Ph.D. Thesis) 1970 227 p
Avail: Univ. Microfilms Order No. 70-18628

A general investigation of the transient response of semiconductor junction diodes is presented. Because of the complexity of the general diffusion equation and the time-dependent boundary conditions which characterize the transient behavior of semiconductor junction devices, numerical techniques are used to solve for the reverse recovery. Hence, the investigation provides a coherent analysis of the reverse recovery of p(+)n junction diodes fabricated with an arbitrary geometry and impurity profile. The significant results of all previous work relating to the diode recovery transient are summarized using a common mathematical formulation and a consistent notation. A complete analytical treatment of the current-limited reverse recovery of the long-base, uniformly-doped, p(+)n diode is presented. Dissert. Abstr.

N71-38622# Academy of Sciences (USSR), Moscow.
METHOD OF DETERMINING PARAMETERS OF AMPLITUDE DISCRIMINATORS IN TUNNEL DIODES
V. S. Yelatskiy *In its* Proc. of the 6th Ann. All-Union Winter School on Space Phys., part 2 1969 p 155 In RUSSIAN
(See N71-38582 24-30)
Avail: NTIS

10 ELECTRONICS

Includes circuit theory; and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see specific Physics categories.

N71-37799*# Northeastern Univ., Boston, Mass.
INTERRELATIONS BETWEEN ADVANCED PROCESSING TECHNIQUES, INTEGRATED CIRCUITS, MATERIALS DEVELOPMENT AND ANALYSIS Final Report
W. B. Nowak, B. L. Cochrun, W. Carlson, and A. Grabel 1 Jun. 1971 71 p refs
(Grant NGR-22-011-007)
(NASA-CR-123007) Avail: NTIS

CONTENTS:
1. ACTIVE INTEGRATED CIRCUITS B. L. Cochrun, W. Carlson, and A. Grabel p 1-33 refs (See N71-37800 24-10)
2. METALLURGICAL STUDIES OF MICROCIRCUIT INTERCONNECTIONS W. B. Nowak, T. Hull, and P. Selmon p 34-56 refs (See N71-37801 24-10)
3. BIOPHYSICAL STUDIES S. Fine p 57-65 refs (See N71-37802 24-16)

N71-37800*# Northeastern Univ., Boston, Mass.
ACTIVE INTEGRATED CIRCUITS
B. L. Cochrun, W. Carlson, and A. Grabel *In its* Interrelations Between Advan. Process. Tech., Integrated Circuits, Mater. Develop. and Analysis 1 Jun. 1971 p 1-33 refs (See N71-37799 24-10)
Avail: NTIS

The use of gyrators for tuned IF amplifiers is studied with the development of a 455 kHz AM amplifier which would be suitable for integrated circuits. The practical realization of a gyrator utilizing stable NIC configurations in cascade is also considered. Author

N71-37801*# Northeastern Univ., Boston, Mass.
METALLURGICAL STUDIES OF MICROCIRCUIT INTERCONNECTIONS
Welville B. Nowak, Thomas Hull, and Peter Selmon *In its* Interrelations Between Advan. Process. Tech., Integrated Circuits, Mater. Develop. and Analysis 1 Jun. 1971 p 34-56 refs
(See N71-37799 24-10)
Avail: NTIS

The behavior of vacuum evaporated films of Au, Pt, and Au-on-Pt, on glass substrates was observed after various heat treatments. Film thicknesses were 250 to 1800 A and 4000 to 9000 A for the Pt and Au, respectively. Heat treatment schedules were: one hour in air at temperature intervals of 50 C from 100 to 650 C, or increments of one hour, up to a total of seven hours, at 675 C in air. Room temperature electrical resistivity and spectral reflectivity (over the visible band) indicated the following: (1) Pt films appear to recrystallize when heated above 350 C, (2) Au-on-Pt couples blister when heated above 100 C, and (3) an upper limit for the diffusion constant of the solubility phase boundary of Au in Pt at 675 C appears to be D = 3 x 10 to the -16th power sq cm/sec. Author

N71-37802*# Northeastern Univ., Boston, Mass. c18
BIOPHYSICAL STUDIES
S. Fine *In its* Interrelations Between Advan. Process. Tech., Integrated Circuits, Mater. Develop. and Analysis 1 Jun. 1971 p 57-65 refs (See N71-37799 24-10)
Avail: NTIS

Some hazards associated with laser radiation are assessed, and methods are determined in which laser radiation can be used as a tool in biology and medicine. Toxic and explosive hazards associated with lasers, thermal models applied to retinal threshold injury, exploration of potential carcinogenic effects of

pulsed laser radiation, anterior chamber measurements on CO2 laser corneal irradiation, corneal calcification, rupture and tensile strength measurements of the treated canine aortic tissue, and lasers in biology and medicine are briefly reviewed, as well as pathology of internal viscera following laser radiation and biological testing of laser protective materials. Preventable hazard at UW wavelengths, heat sensation thresholds for CO2 laser radiation, and cardiac output determination by dye dilution are also outlined. J.A.M.

N71-37803*# Mississippi State Univ., State College. Dept. of Electrical Engineering.
COMPENSATOR IMPROVEMENT WITH AN APPLICATION TO A LARGE SPACE VEHICLE
Jarrel R. Mitchell 30 Sep. 1971 32 p refs
(Contract NASS-21377)
(NASA-CR-119959) Avail: NTIS CSCL 09C

The required specifications for a computerized compensator improvement program are submitted. Several definitions in regard to relative stability are presented along with some frequency response limitations and characteristics of a large space vehicle. A nonlinear programming algorithm for obtaining a solution for a strict constraint problem is developed and the necessary partial derivatives for applying the algorithm to compensator improvement are derived. Finally, for illustrating the effectiveness of the algorithm, two examples of improving the frequency response characteristics of a large space vehicle are presented along with helpful programming hints. Author

N71-37804*# Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.
DEVELOPMENT OF MICROCIRCUITS FOR SPACE APPLICATIONS Final Report
L. N. Tharp 15 Sep. 1971 51 p refs
(Contract NASS-25667; Proj. A-1240)
(NASA-CR-121013) Avail: NTIS CSCL 09C

The application of Auger electron spectroscopy was studied as an analytical method for detecting impurities introduced during processing of semiconductor devices, and the correlation was explored between surface contamination and selected device parameters in silicon devices. A number of silicon wafers were examined selected from various stages of device processing with Auger spectroscopy. These data were correlated with known factors in the device manufacturing process as well as electrical measurements of device performance after several key process steps. Author

N71-37805# Naval Postgraduate School, Monterey, Calif.
OPTIMIZATION OF SYSTEMS WITH SENSITIVITY CONSTRAINTS
Ramon Ronald Owens (M.S. Thesis) Mar. 1971 143 p refs
(AD-727138) Avail: NTIS CSCL 12/1

A cohesive and detailed treatment of the theory and engineering implications of trajectory sensitivity is presented. Fundamental results that provide insight into the theoretical aspects of trajectory sensitivity analysis, in both the frequency and time domains, are reviewed. Several related methods for incorporating sensitivity considerations in the design of systems are presented and used to solve a meaningful fifth-order numerical example: a flexible space vehicle in booster powered flight. Comparisons are made between an optimal design and designs which include a sensitivity term in the performance measure and conclusions are drawn about the efficacy of these techniques in control system design. Author (GRA)

N71-37806# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
HIGH POWER ELECTRONICS, VOLUME 1, 1962
P. L. Kapitsa 22 Apr. 1971 152 p refs Transl. into ENGLISH of the book "Elektronika Bolshikh Moshchnostey Vol. 1" USSR, 1962 p 1-158
(AD-727888; FTD-HC-23-244-70) Avail: NTIS CSCL 09/1

The electron motion in the presence of a magnetic field is investigated theoretically and experimentally. Equations of electron motion are solved based on eliminating the periodicity of occurring processes. The planotron and magnetron are studied in detail and the resonance action of a high frequency field on the circular (Larmor) motion of charged particles is described. Problems which could have been solved by the planotron in high power electronics are reviewed. N.E.N.

N71-37807# California Inst. of Tech., Pasadena.
CONDUCTION ELECTRON LOCALIZED MOMENT INTERACTION IN PALLADIUM-SILICON BASE AMORPHOUS ALLOYS CONTAINING TRANSITION METALS
Ryusuke Hasegawa (Ph.D. Thesis) 1969 109 p refs Sponsored in part by AEC
Avail: NTIS

The electrical and magnetic properties of amorphous alloys obtained by rapid quenching from the liquid state were studied. The composition of these alloys corresponds to the general formula M(x)Pd(80-x)Si20, in which M stands for a metal of the first transition series between chromium and nickel and x is its atomic concentration. The concentration ranges within which an amorphous structure could be obtained were: from 0 to 7 for Cr, Mn, and Fe, from 0 to 11 for Co and from 0 to 15 for Ni. A well-defined minimum in the resistivity vs temperature curve was observed for all alloys except those containing nickel. The alloys for which a resistivity minimum was observed had a negative magnetoresistivity approximately proportional to the square of the magnetization and their susceptibility obeyed the Curie-Weiss law in a wide temperature range. For concentrated Fe and Co alloys the resistivity minimum was found to coexist with ferromagnetism. Author

N71-37808 California Univ., Berkeley.
EQUIVALENCE IN NONLINEAR CIRCUITS
Jai Prakash Verma (Ph.D. Thesis) 1969 87 p
Avail: Univ. Microfilms Order No. 70-17677

Based on Caratheodory's theorem in thermodynamics, a definition of local controllability is obtained and a reasonable criterion is developed for systems of the type dx/dt = f(x,u) with x epsilon R to the nth power, u epsilon R to the mth power. Using this, it shown first that for similar input-output pairs, the only diffeomorphic map relating the state spaces of the differential systems N and M is isometric when restricted to the subspace spanned by the velocity vectors of the system. It is shown that for a large class of nonlinear complete circuits, this diffeomorphic map must indeed be an isometry on the whole space i.e., the systems N and M are equivalent. Some stability results are obtained for RC or RL complete circuits. With monotonic increasing resistors, it is shown that for constant or asymptotically constant bounded inputs, the solutions of these circuits attain asymptotically steady state; have bounded output for bounded input; and with a periodic input of period T, there exists at least one periodic solution of period T. Dissert. Abstr.

N71-37809 New York Univ., N.Y.
PRACTICAL REALIZATIONS OF ARBITRARY RATIONAL ADMITTANCE MATRICES USING OPERATIONAL AMPLIFIERS AND RC ONE-PORTS
Murray Abraham Goldman (Ph.D. Thesis) 1969 144 p
Avail: Univ. Microfilms Order No. 70-8776

A synthesis procedure pertinent to the general problem of synthesizing arbitrary rational admittance matrices is presented. The matrix is realized by a practical network containing voltage controlled voltage sources (VCVS's) and RC one port admittances. Of particular interest are the features of (1) being able to compensate for non-ideal controlled sources and (2) allowing the designer to constrain the range of all passive RC element values required in the realization. The model used for the controlled sources includes the source input and output immittances and also an assumed one pole gain-frequency response if the controlled source is used at high gain. Constraints on element values can be specified at the outset along with the desired

admittance matrix. The control over the element values is obtained at the expense of gain and/or additional controlled sources. Finally, the technique has the advantage of being very simple to apply since the task of N-port synthesis is reduced to that of one port RC synthesis. Dissert. Abstr.

N71-37810 Purdue Univ., Lafayette, Ind.
ON THE SOLUTION OF OPTIMAL CONTROL PROBLEMS WITH STATE VARIABLE INEQUALITY CONSTRAINTS
William Eugene Hamilton, Jr. (Ph.D. Thesis) 1970 167 p
Avail: Univ. Microfilms Order No. 70-18655

The computational methods developed solve bounded state variable problems by searching the constraint surface (or boundary) for the optimal junction point between the subarc on the boundary and the unconstrained subarc. The problem to be solved is stated, necessary conditions for its solution are given, and the theory of the computational method which will be employed is discussed. A derivation of the condition for separate computation of areas which differs from previous derivations is presented. The derivation establishes a connection with the classical calculus of variations. It is proposed that the neighboring optimum method be used to solve separable problems and several examples are given. Dissert. Abstr.

N71-37811 New York Univ., N.Y.
TOPICS IN LEAKY SPACE-CHARGE WAVES
Yen-chu Wang (Ph.D. Thesis) 1969 149 p
Avail: Univ. Microfilms Order No. 70-9793

Leaky space charge waves are used to explain Cerenkov and Smith-Purcell radiation. The Palocz and Oliner self-consistent theory of leaky space-charge waves is amplified. The Cerenkov effects of a modulated solid electron beam in a finite dielectric region and of a ribbon beam passing between two semi-infinite dielectric regions are presented. Smith-Purcell radiation effects and Wood anomalies of a modulated sheet beam passing between two parallel planar strip transmission grating are investigated. In order to take simultaneously backward and forward radiating waves into account it was necessary to know the behavior of the grating when three modes are present and these waves are coupled. An integral equation was set up and solved under these conditions, and the results are presented in the form of an equivalent network. This calculation made it possible to treat sudden amplitude variation connected with the onset of radiation modes. Dissert. Abstr.

N71-37812 Southern Methodist Univ., Dallas, Tex.
STOCHASTIC SEQUENTIAL CIRCUITS
Hassan Nabil El-Sayed El-Ghoroury (Ph.D. Thesis) 1970 117 p
Avail: Univ. Microfilms Order No. 70-19256

Stochastic sequential circuits are defined as deterministic sequential circuits fed by random inputs (noise). Their importance is analogous to the importance of deterministic sequential circuits in realizing sequential machines. Fed with noise, the sequential circuit behaves like a stochastic sequential machine. The noise is introduced as a sequence of independent Bernoulli trials. The probabilistic logical operations are defined as a mathematical extension of the deterministic definition of the binary logical operations; AND, OR and EXCLUSIVE OR. As a consequence of this extension additive noise linear sequential circuits (ANLSC) are introduced and analyzed. Behavioral response, state equivalence, minimization and asymptotic behavior are considered. Using convex probability addition of independent Bernoulli trials, stochastic vectors and stochastic matrices are implemented. Two schemes to realize any stochastic sequential machine are devised. The relation between stochastic and deterministic state equivalence is found. Dissert. Abstr.

N71-37813 Virginia Polytechnic Inst., Blacksburg.
RANDOMLY-MODULATED PHASE-LOCKED LOOP WITH A LEAD-LAG FILTER
Pradip Kumar Gohain (Ph.D. Thesis) 1970 58 p
Avail: Univ. Microfilms Order No. 70-19195

The investigation of the non-linear behavior of the second-order phase locked loop (PLL) containing a lead-lag filter under the consideration that the received carrier is frequency modulated by a stationary Gaussian process, is discussed. The carrier is also assumed to be corrupted by an additive white Gaussian noise process at the input to the PLL. The analytical solution for the phase error distribution obtained by using the Fokker-Planck technique, is found to reduce to several existing solutions for the first and the second order loops. In order to solve the three-dimensional Fokker-Planck equation involving the joint distribution a quasi-separation of variable and recurrent generation technique is employed. The analytical results for phase-error distribution and variance are also graphically compared with simulation output data obtained through system/360 continuous system modeling program (CSMP). This program provides a convenient means for simulating the problem directly from the modified phase equivalent model of the phase locked loop. Dissert. Abstr.

N71-38634# Naval Research Lab., Washington, D.C. Solid State Technology Branch.
EXPERIMENTAL STUDY AT AUDIO FREQUENCIES OF A HALF-WAVE RECTIFYING CIRCUIT WITH A THEORETICAL EFFICIENCY OF 100 PERCENT
W. C. Jenkins *In its* Rept. of NRL Progress, Sep. 1971 Sep. 1971 p 1-4 refs (See N71-38633 24-30)
Avail: NTIS

11 FACILITIES, RESEARCH AND SUPPORT

Includes airports; lunar and planetary bases including associated vehicles; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands, shock tubes, and wind tunnels); test ranges; and tracking stations.

N71-37814# Comitato Nazionale per l'Energia Nucleare, Frascati (Italy).
EXPERIMENTAL ACTIVITIES AT BONN, HIGH ENERGY EXPERIMENTS BELOW 1 GeV
G. VonHoltey Dec. 1970 28 p refs Presented at Meeting on Electronsynchrotron, Frascati, Italy, 5-7 Nov. 1970
(LNF-70/59; Conf-701121-2) Avail: AEC Depository Libraries

The experimental facilities and the high energy research programs (up to 1 GeV) at 500-MeV and 2.5-GeV electron synchrotrons are described. NSA

N71-37815# Joint Publications Research Service, Washington, D.C.
DEVELOPMENTS IN PRESSURE CHAMBER TECHNOLOGY
I. Ye. Baranik 1 Oct. 1971 29 p refs Transl. into ENGLISH from Med. Tekhn. (Moscow), no. 3, May - Jun. 1971 p 29-31, 38-40, and 48-55
(JPRS-54173) Avail: NTIS

CONTENTS:

1. ANALYSIS OF STRUCTURAL STRENGTH OF THE SHELL OF A THERAPEUTIC PRESSURE CHAMBER BUILT OF ORTHOTROPIC TWO-PLY FIBERGLASS I. Ye. Baranik et al p 1-4 (See N71-37816 24-32)
2. HYPERBARIC CHAMBER (okslber-1) S. A. Glukhov et al p 5-12 refs (See N71-37817 24-11)
3. PRESENT STATE AND FUTURE DEVELOPMENT OF HYPERBARIC OXYGENATION I. V. Sultanov et al (See N71-37818 24-04)
4. EXPERIMENTAL SURGICAL PRESSURE CHAMBER OF THE INSTITUTE OF CARDIOVASCULAR SURGERY IMENI A. B. BAKULEV OF THE ACADEMY OF MEDICAL SCIENCES OF THE USSR V. I. Buraikovskiy et al p 22-28 (See N71-37819 24-11)

N71-37816# Joint Publications Research Service, Washington, D.C.
ANALYSIS OF STRUCTURAL STRENGTH OF THE SHELL OF A THERAPEUTIC PRESSURE CHAMBER BUILT OF ORTHOTROPIC TWO-PLY FIBER GLASS c32
I. Ya. Baranik et al *In its* Develop. in pressure Chamber Technol. 1 Oct. 1971 p 1-4 (See N71-37815 24-11)
Avail: NTIS

The critical tensile strength curve for orthotropic two-layer fiber glass shells in a plane stressed state corresponding to a tension-tension state was investigated for therapeutic pressure chambers. Equations are given for the determination of axial stresses due to tensile force loading and pressure and annular stresses due to internal liquid pressure. J.M.

N71-37817# Joint Publications Research Service, Washington, D.C.
HYPERBARIC CHAMBER 'OKSIBAR-1'
S. A. Glukhov et al *In its* Develop. in Pressure Chamber Technol. 1 Oct. 1971 p 5-12 refs (See N71-37815 24-11)
Avail: NTIS

The basic requirements for large-size therapeutic pressure chambers are summarized. Basic systems are discussed including biological information and safeguarding, two-way communication, microclimate, compression, decompression, and scavenging. A model hyperbaric chamber based on a PDK-2 chamber concept was tested for hyperbaric oxygenation treatments of 30 to 90 min duration at pressures from 1 to 3 atm. The test procedures and preliminary results are described. J.M.

N71-37818# Joint Publications Research Service, Washington, D.C.
PRESENT STATE AND FUTURE DEVELOPMENT OF HYPERBARIC OXYGENATION c04
I. V. Sultanov et al *In its* Develop. in Pressure Chamber Technol. 1 Oct. 1971 p 13-21 (See N71-37815 24-11)
Avail: NTIS

Functional technical and medical advantages and disadvantages of therapeutic hyperbaric oxygenation chambers are summarized. One-person, two-person, multiple-person, and experimental pressure chambers are included. J.M.

N71-37819# Joint Publications Research Service, Washington, D.C.
EXPERIMENTAL SURGICAL PRESSURE CHAMBER OF THE INSTITUTE OF CARDIOVASCULAR SURGERY IMENI A. N. BAKULEV OF THE ACADEMY OF MEDICAL SCIENCES OF THE USSR
V. I. Burakovskiy et al *In its* Develop. in Pressure Chamber Technol. 1 Oct. 1971 p 22-28 (See N71-37815 24-11)
Avail: NTIS

A description is given of an experimental surgical pressure chamber including the two compressed air systems and the chamber equipment. The lighting and air analysis systems are covered as well as the chamber operational capabilities. J.M.

N71-37820# Federal Aviation Administration, Washington, D.C.
MEASUREMENT OF RUNWAY FRICTION Minutes of Meeting
15 Apr. 1971 189 p refs Conf. held in Washington, D. C., 2-3 Feb. 1971
(FS-180-65-68-2) Avail: NTIS

Four basic problems associated with wet, icy, and slush or snow covered runways were identified as aircraft stopping distance, aircraft directional control in a crosswind, engine ingestion effects, and slush drag effects. The first two of these problems were treated in detail. Nine influences on aircraft stopping distance and seven influences on directional control were listed and the effects of each were discussed. Statistics were presented on veer-off and overrun accidents for the 1967 to 1969 period. Traction test data were presented to illustrate the effect of rubber deposits on slipperiness of normal, grooved, and sealed runways. The proceedings are summarized and the minutes of the discussion session are included. J.G.M.

N71-37821# Naval Ordnance Lab., White Oak, Md.
NOL HYPERVELOCITY WIND TUNNEL. REPORT NO. 2: NOZZLE DESIGN
Walter J. Glowacki 30 Apr. 1971 129 p refs
(AD-727591; NOLTR-71-6; Rept-2) Avail: NTIS CSCL 14/2

The NOL hypervelocity wind tunnel will provide a high Reynolds number turbulent flow simulation in the Mach number range 10 to 20. This facility, much needed for large-scale testing of hypersonic vehicles, will be operational late in 1972. This report presents the detailed procedure used to design three nozzles for the facility. Pressure and temperature effects on the thermodynamic properties of nitrogen are taken into account in both the inviscid core and the boundary layer calculations. The supersonic portion of the inviscid core is calculated by the method of characteristics and the subsonic portion is approximated as a one-dimensional flow. The boundary layer calculation procedure is based on an integral moment of momentum equation and is valid for thick as well as thin boundary layers. GRA

N71-37822# Office of Naval Research, London (England).
A DAY AT THE BROWN BOVERI RESEARCH CENTER
Edward I. Salkovitz 16 Jun. 1971 12 p
(AD-727597; ONRL-R-16-71) Avail: NTIS CSCL 14/2

The Brown Boveri Center is in a sense the corporate laboratory of the parent multinational company. The report briefly describes the laboratory's function within the organization, its management and the three main areas of research. The latter center around solid state physics, physics of fluids, and automatic control and instrumentation. Directional solidification of the cobalt chromium carbide system, as well as physical properties of certain carbides and carbon fibers are discussed. There then follows an example of a problem in 'reduction to practice', namely, the need to maintain integrity in sizable p-n silicon junctions. A description is also given of some of the work in the field of coherent optics as well as technological interests in plasma physics. Finally, mention is made of the more recent venture at the laboratory into automatic control. Author (GRA)

N71-37823*# National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.
VALIDATION OF A GENERAL PURPOSE AIRBORNE SIMULATOR FOR SIMULATION OF LARGE TRANSPORT AIRCRAFT HANDLING QUALITIES
Kenneth J. Szalai Washington Oct. 1971 73 p refs
(NASA-TN-D-6431; H-591) Avail: NTIS CSCL 14B

A flight simulation program was conducted to validate the general purpose airborne simulator (GPAS) for handling-qualities studies of large transport aircraft in cruise. Pilots compared flying qualities of the XB-70-1 with those simulated on the GPAS during consecutive flights of the two vehicles. In addition, various handling-qualities parameters and time histories for the XB-70 and the airborne simulator were compared to assess simulator fidelity. The GPAS was shown to be capable of accurate and realistic simulation of the XB-70 at two flight conditions (Mach 1.2 at 12,200 meters (40,000 feet) altitude and Mach 2.35 at 16,800 meters (55,000 feet) altitude). In-flight changes to the programed model were required to obtain a satisfactory simulation from the pilot's point of view. In most instances, these changes were necessary to improve model representation of the XB-70 rather than to correct for possible simulator-introduced distortions. Author

N71-37824# Federal Aviation Administration, Washington, D.C.
NATIONAL TRANSPORTATION PLANNING MANUAL (1970 - 1990). MANUAL D: AIRPORTS AND OTHER INTERCITY TERMINALS
Apr. 1971 121 p

(OMB-04-S71002) Avail: NTIS

General instructions relating this manual to the 1972 National Transportation Needs study are presented as well as instructions for the preparation of information related to airports and other intercity terminals. Needs estimates for 1970 to 1990 and capital improvement programs for fiscal years 1974 to 1978 and 1979 to 1990 are discussed. The development of airport needs estimates, capital improvement programs, and reporting requirements are included. Terminal issues and the development of needs estimates and capital improvement programs for other intercity terminals are also covered. Author

N71-37825# Wilson, Ihrig and Associates, Inc., Berkeley, Calif.
NOISE AND VIBRATION CHARACTERISTICS OF HIGH SPEED TRANSIT VEHICLES
Jun. 1971 99 p refs
(Contract DOT-OS-A9-032)
(OST-ONA-71-7) Avail: NTIS

A review of the available information on wayside noise and vibration generated by rapid transit vehicles, primarily rail transit vehicles is presented. A projection of the expected noise and vibration levels for higher vehicles being considered for future applications is included. Author

N71-37826# National Aviation Facilities Experimental Center, Atlantic City, N.J.
DALLAS-FORT WORTH TOWER CAB DESIGN EVALUATION Final Report, Jul. 1970 - May 1971
J. Roy Bradley, Jr. Nov. 1971 19 p
(FAA-NA-71-37; FAA-RD-71-77) Avail: NTIS

The design concept and operational feasibility of an undecagon (11-sided) control tower cab for the new Dallas-Fort Worth Regional Airport are discussed. A report was made on position and equipment arrangements, tower console design, and operational factors resulting from the study. A full-scale plywood mockup of the tower cab and consoles was constructed. After installation of equipments and displays, a 30-day evaluation was conducted. Results indicate that the design concept of the 11-sided tower cab for the Dallas-Fort Worth Regional Airport is valid and that it is highly feasible from an operational aspect. Position arrangements and the console design are considered excellent. An improved equipment arrangement was developed and recommended. Author

N71-37827# Boeing Scientific Research Labs., Seattle, Wash. Aerospace Group.
DESIGN AND OPERATION OF THE BSRL WATER TUNNEL
John N. Olsen Sep. 1971 28 p refs
(D180-14130-1) Avail: NTIS

The design, construction, and performance of a water tunnel for two-dimensional testing of pitching airfoils is described. The test section is 4.5 inches x 12 inches x 36 inches long. The tunnel can run at 40 feet/second, but cavitation may even occur at lower speeds depending on the pressure coefficients on the model. A practical limit for say an NACA 0012 airfoil is 20 feet/second if cavitation is to be avoided. The velocity profile is uniform within at least 1% and the turbulence level is below .15%. Author

N71-38617# Academy of Sciences (USSR), Moscow.
SPARK CHAMBERS
Ye. A. Damaskinskiy *In its* Proc. of the 6th Ann. All-Union Winter School on Space Phys., part 2 1969 p 133-141 refs In RUSSIAN (See N71-38582 24-30)
Avail: NTIS

N71-37902# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Flugfunk und Mikrowellen.
REPORT ON ZDBS (ZENTRALSTATION DES DEUTSCHEN BODENSYSTEMS)
H. Oettl *In* Max-Planck-Inst. fuer Aeronomies Future Appl. of Satellite Beacon Expt. Nov. 1970 7 p refs (See N71-37903 24-13)
Avail: NTIS HC $3.00/MF $0.95

N71-38565*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DESCRIPTION OF THE DEEP SPACE NETWORK: DSN FUNCTIONS AND FACILITIES
N. A. Renzetti *In its* The Deep Space Network, Vol. 5 15 Oct. 1971 p 1-3 ref (See N71-38564 24-30)
Avail: NTIS CSCL 22A

N71-38568*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
[DEVELOPMENT AND IMPLEMENTATION: SPACE FLIGHT OPERATIONS FACILITY AND GROUND COMMUNICATIONS FACILITY DEVELOPMENT]
C. L. Zandell and D. S. Bremner *In its* The Deep Space Network, Vol. 5 15 Oct. 1971 p 129-135 refs (See N71-38564 24-30)
Avail: NTIS CSCL 14B

N71-38569*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
OPERATIONS AND FACILITIES: PIONEER F AND G MISSION SUPPORT AREA
A. H. Hofmann *In its* The Deep Space Network, Vol. 5 15 Oct. 1971 p 136-145 refs (See N71-38564 24-30)
Avail: NTIS CSCL 14B

12 FLUID MECHANICS

Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. For related information see also: 01 Aerodynamics; and 33 Thermodynamics and Combustion.

N71-37828# Danish Atomic Energy Commission, Risoe.
TWO-PHASE FLOW MEASUREMENTS UTILIZING LASER ANEMOMETRY
Lars Lading Apr. 1971 10 p refs Presented at the Symp. on the Study of Flow and Turbulence by Laser Doppler Tech., Coventry, England, 17 Mar. 1971
(RISO-M-1368; Conf-710318-1) Avail: AEC Depository Libraries

A review is given of the feasibility of using laser anemometry (Doppler) for measuring flow parameters in two phase flow. In principle it is possible to perform measurements without disturbing the flow. The basic configuration chosen is described. Some problems specific to two phase measurements are treated. Author (NSA)

N71-37829*# United Aircraft Corp., East Hartford, Conn.
INITIAL EXPERIMENTS TO INVESTIGATE CONDENSATION OF FLOWING METAL-VAPOR/HEATED-GAS MIXTURES IN A DUCT Interim Summary Technical Report, 16 Sep. 1970 - 15 Sep. 1971
Harold E. Bauer Sep. 1971 44 p refs
(Contract SNPC-70)
(NASA-CR-123200; ITR-2; K-910900-9) Avail: NTIS CSCL 20D

An exploratory experimental study of the condensation of a metal vapor carried in a flowing stream of noncondensible gas in a duct was conducted to provide information which could be used in the design of the cavity exhaust ports of a nuclear light bulb engine and an in-reactor test unit. Condensation was initiated by adding a sufficient quantity of cold noncondensible gas to a heated vapor/gas mixture to reduce the mixed mean

temperature to a level below the melting point of the condensible material. A series of preliminary tests were conducted using iodine and air as the vapor/gas mixture. The air and iodine were heated electrically in an oven to produce the heated vapor/gas mixture which was then cooled by mixing with additional cold air at the inlet to a 1.0 m long pyrex tube test section. Subsequent test series were conducted using zinc and argon as the vapor/gas mixture. Argon was preheated using a dc arc plasma torch and was then passed through a vaporizer section containing zinc. At the test section, cold argon was used to cool the mixture. In the iodine/air tests, condensation on the test section walls could be eliminated by maintaining the test section walls at a temperature approximately 10 to 15 K above the mixed-mean temperature of the flow in the tube. Author

N71-37830*# Case Western Reserve Univ., Cleveland, Ohio. Div. of Fluid, Thermal and Aerospace Sciences
EXPERIMENTAL MEASUREMENTS OF GRID-INJECTION TURBULENT FLOWS
Julian C. H. Liu, I. Greber, and H. K. Wiskind Jan. 1971 88 p refs
(Grants NGR-36-003-064; NGR-36-027-008)
(NASA-CR-123191; FTAS/TR-70-53) Avail: NTIS CSCL 20D

A combination of a grid and jet injection parallel to a main flow was used to generate turbulence. The structure and characteristics of the resulting turbulent flow were studied. For all injection rates, the energy containing eddies of the generated turbulence were found to have the same characteristic length as the mesh size of the grid used. The turbulence Reynolds number could be increased as much as fivefold by the use of injection. The inertial subrange with slope -5/3 on energy spectra could be seen clearly at the highest injection rate. An effort was made to make the mean velocity field as uniform as possible as part of an attempt to make the turbulence field homogeneous. Energy decay and spectra measurements were taken, and the results were compared with the experimental results of zero injection (standard grid turbulence) and with theories of homogeneous turbulence. Author

N71-37831*# Techtran Corp., Glen Burnie, Md.
ANOMALIES OBSERVED IN THE FLOW OF LIQUIDS THROUGH HARD FINE-PORED FILTERS [ANOMALNYYE YAVLENIYA PRI TECHENII ZHIDKOSTEYI CHEREZ ZHESTKIYE UZKOPORISTYYE FILTRY]
B. V. Deryagin et al Washington NASA Oct. 1971 5 p refs Transl. into ENGLISH from Soveshch. po Vyazk Zhidkostyi Kalloydov, 2-oga. (USSR), 1944 p 52-53
(Contract NASw-2037)
(NASA-TT-F-13989) Avail: NTIS CSCL 20D

Special mechanical properties of thin liquid films formed in filter pores were analyzed by studying anomalies observed in the flow of liquids through porous ceramic and carbon filters. The effective additives such as isoamyl alcohol, isovaleric acid, ethyl alcohol, and oleic acid on the viscosity and flow properties of the liquid were examined. Small additives of ethyl alcohol cause a slight increase in flow rate. Additives of isoamyl alcohol and isovaleric acid speed up the rate of filtration 4 and 5 fold, respectively. Author

N71-37832*# Translation Consultants, Ltd., Arlington, Va.
THE SOUND AND FLOW FIELD OF AN AXIALLY SYMMETRIC FREE JET UPON IMPACT ON A WALL [ZUM SCHALL- UND STROEMUNGSFELD EINES AXIALSYMMETRISCHEN FREISTRAHLS BEIM AUFTREFFEN AUF EINE WAND]
F. R. Wagner Washington NASA Oct. 1971 33 p refs Transl. into ENGLISH from Z. Flugwiss. (West Germany), v. 19, Jan. 1971 p 30-44
(Contract NASw-2038)
(NASA-TT-F-13942) Avail: NTIS CSCL 20D

An investigation was made to determine the mechanism responsible for some phenomena observed in the case when a circular subsonic free jet impinges on a wall at jet exit Mach numbers upwards of 0.6 and at distances from the wall less than 5 to 6 times the nozzle diameter. Specifically, an observed stationary wave pattern in the jet core, periodical ring vortices at the jet boundary, and pronounced frequencies of high intensity in the noise and turbulence spectrum were considered. A feedback between the flow and the pressure field generated by it was found to be responsible for these phenomena. Author

N71-37833# United Kingdom Atomic Energy Authority, Capenhurst (England).
NUMERICAL SOLUTION OF THE NAVIER-STOKES EQUATIONS TO CALCULATE INCOMPRESSIBLE CENTRIFUGE FLOWS
E. Krause [1970] 17 p refs Transl. into ENGLISH from German conf. paper
(Conf-700557-4; Capenhurst-Trans-251) Avail: AEC Depository Libraries

A new method is given for calculating the flow processes in gas centrifuges. The solution assumes that the flow can be described by a continuum concept. The non-steady Navier-Stokes equations and the energy equation form the starting point of this work. Using finite difference approximations the complete equations of motion are integrated in a cylindrical co-ordinate system. The axial symmetry of the problem is used to transform the original three-dimensional problem to a two-dimensional problem. Then a flow function can be introduced to satisfy the continuity equation. The tangential and radial velocities of the flow are determined as dependent on time. In a final calculation the Lagrange paths of the gas particles are determined. The throughput quantity and the width and arrangement of the throughput slits can be varied within definite limits. The method permits one to predict the effect of simple devices on the secondary flow. Author

N71-37834*# Purdue Research Foundation, Lafayette, Ind. School of Mechanical Engineering.
SHOCK INDUCED BOUNDARY LAYER OVER A SEMI-INFINITE FLAT PLATE. PART 1: FLOW IN THE IMMEDIATE VICINITY OF THE SHOCK WAVE
Douglas E. Abbott and Michael I. O. Ero Dec. 1970 58 p refs
(Grant NGR-15-005-077)
(NASA-CR-123159; FMTR-70-1-Pt-1) Avail: NTIS CSCL 20D

The problem considered is the laminar, two-dimensional boundary layer generated in the immediate vicinity of a plane shock wave moving over a flat plate into a gas initially at rest. Results are obtained for both a perfect gas and a real gas in thermodynamic equilibrium (nitrogen). The analytical method employed is the method of weighted residuals or MWR. It is shown that the MWR first approximation agrees within six percent with the results for skin friction coefficient given for a perfect gas; an MWR second approximation is also computed and shows agreement within one percent or better. Real gas solutions are calculated for an MWR second approximation and compared with the perfect gas results. The primary utility of the work is its application to the shock induced flow over a semi-infinite flat plate where the leading-edge is taken into account. Author

N71-37835*# Hamilton Standard, Windsor Locks, Conn.
DEVELOPMENT OF ATMOSPHERIC GUST CRITERIA FOR SUPERSONIC INLET DESIGN Final Report
Frank W. Barry Dec. 1968 206 p refs
(Contract NAS2-4515)
(NASA-CR-114372; HSER-5196) Avail: NTIS CSCL 20D

A method was developed for relating transient tolerances in inlet throat Mach number and shock position to the frequency of unstarts of a supersonic inlet due to atmospheric disturbances. Data on high-altitude atmospheric turbulence was collected and evaluated. A general linear analytical model was developed to compute changes in inlet throat Mach number and shock position. The relation of inlet transient tolerances to propulsion system performance is presented. A stepwise procedure for relating frequency of inlet unstarts to transient tolerances is given and applied to a representative example. Author

N71-37836*# Pratt and Whitney Aircraft, East Hartford, Conn.
SINGLE STAGE EVALUATION OF HIGHLY LOADED HIGH MACH NUMBER COMPRESSOR STAGES. 4: DATA AND PERFORMANCE OF HUB SLIT SUCTION STATOR
G. D. Burger and G. Bogardus. 10 Nov. 1971 133 p refs
(Contract NAS3-10482)
(NASA-CR-120802; PWA-4186) Avail: NTIS CSCL 20D

A single stage compressor with a rotor tip speed of 1600 fps and 0.5 hub/tip ratio was used to demonstrate the effects of boundary layer suction through slits at the intersection of the stator suction surface and the hub wall. No efficiency benefit was obtained at design speed; 1.5 percentage points improvement was obtained at part speed. Maximum design speed stage efficiency of 82.7 percent was obtained at a pressure ratio of 1.935. Accounting for rotor work on the flow bled through the stator hub slit decreases this efficiency 0.5 percent. Author

N71-37837# Royal Aircraft Establishment, Farnborough (England).
THE DYNAMICS OF A DROP OF A CONDENSATE IN THE AXIAL GAP OF A TURBINE STAGE
R. G. Perel'man. Jul. 1971 10 p refs Transl. into ENGLISH from Izv. Vuzov SSSR, Energ. (USSR), v. 11, 1969 p 119-122
(RAE-LIB-TRANS-1602) Avail: NTIS

The stripping of a liquid film from the trailing edge of a turbine blade is accompanied by a wave motion. This causes the resulting droplets to oscillate periodically while being accelerated by the gas flow, their shapes being that of flattened spheroids. Effective radius changes of up to 25% have been measured from filmed sequences. As flattening results in higher impact forces, this parameter must be considered when estimating the maximum impulse during the collision of a drop with a turbine blade.
Author

N71-37838# Commonwealth Scientific and Industrial Research Organization, Aspendale (Australia). Div. of Meteorological Physics.
THE WANGARA EXPERIMENT: BOUNDARY LAYER DATA
R. H. Clarke, A. J. Dyer, R. R. Brook, D. G. Reid, and A. J. Troup. 1971 360 p refs *Its* Tech. Paper No. 19
Avail: NTIS HC $6.00/MF $0.95

Data, minimally interpreted, for the Wangara expedition to Hay, N.S.W.(34 deg 30 min S., 144 deg 56 min E.) from 15 July to 27 August, 1967, are presented, together with daily surface isobaric charts. The data consist of: (1) hourly pilot balloon winds up to 2 km, except where the balloon was obscured (by cloud, etc.), averaged over five stations; (2) radiosonde temperatures and mixing ratios at the same levels at 3-hourly intervals, measured at the central station; (3) micrometeorological measurements of most winds and potential temperature; (4) surface observations of pressure, dry and wet bulb temperature, weather, cloud type and amount, and surface wind direction; (5) geostrophic winds at the surface; (6) thermal winds from 0 to 1 and 1 to 2 km, as estimated twice per day from the Bureau of Meteorology synoptic radiosonde network; and (7) estimates of total acceleration at 500 m. Author

N71-37839# Naval Ordnance Lab., White Oak, Md.
CHARACTERISTICS OF THE SHOCK WAVE GENERATED IN AIR BY A BLASTING CAP
Lippe D. Sadwin and Ermine A. Christian. 18 Jun. 1971 25 p refs
(AD-727083; NOLTR-71-105) Avail: NTIS CSCL 19/1

The propagation of the shock wave generated in air by a very small surface explosion, a commercial No. 6 electric blasting cap, has been studied. A large number of time-resolved pressure histories were recorded with piezoelectric transducers at distances over the range of 3.05 to 60.8 meters from the explosion point. The observed range of peak air shock pressures was from .02 bars down to .0002 bars. Comparisons with TNT surface burst data for much larger explosions show that the peak pressure-distance attenuation exponents are the same. Based on these pressure-distance data, the yield of the No. 6 electric blasting cap used is approximately 0.4 grams of TNT. Even at the lowest peak pressures measured, the wave shapes are characteristic of typical airblast shock waves. An essentially triangular positive pressure phase is followed by a negative pressure phase of much lower amplitude and longer duration; this is unlike the signatures of sonic booms which are highly symmetric. The effect of the asymmetry on the energy density spectrum of the blasting cap is also discussed. Author (GRA)

N71-37840# Naval Postgraduate School, Monterey, Calif.
DEVELOPMENT OF A UNIFIED HEURISTIC MODEL OF FLUID TURBULENCE
Theodore H. Gawain and John W. Pritchett. Feb. 1971 122 p refs
(ARPA Order 981)
(AD-727103; NPS-57GN71021A; NPS-57GN9091A) Avail: NTIS CSCL 20/4

A unified heuristic model of fluid turbulence is proposed which supplements the basic equations of motion and continuity so as to define determinate solutions under a wide variety of conditions. A single set of equations applies to all cases. Only the boundary conditions change for each application. The Reynolds stresses are related to the mean flow heuristically through an eddy viscosity. This also involves the turbulent energy, which is analyzed with the aid of empirical expressions for dissipation and diffusion. A characteristic local length scale is introduced, based on a generalization of von Karmon's mixing length. The model is illustrated by application to a channel and a jet. Agreement with experiment is noted. The report also includes an original analysis of the stress/strain rate relation.
Author (GRA)

N71-37841*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
INVESTIGATION OF SLOSH ANOMALY IN APOLLO LUNAR MODULE PROPELLANT GAGE
Harland F. Scholl, Larry D. Pinson, and David G. Stephens. Washington Oct. 1971 39 p refs Film Supplement Number L-1088 to this report is available on loan from NASA, Langley Research Center
(NASA-TM-X-2362; L-7757) Avail: NTIS CSCL 20D

An experimental and analytical program was conducted to identify a liquid slosh phenomenon in the Apollo lunar module (LM) which resulted in a 30- to 45-second premature indication of a low level of propellant from the propellant quantity gage system (PQGS) in the LM descent propulsion system. This research was conducted to determine the corrective action required to minimize spurious effects due to the interaction of the liquid and gage and to extrapolate laboratory results to LM flight conditions. Developed and qualified were a fixed cylindrical baffle and modified PQGS tube which suppressed the oscillatory motion of the liquid in the tank and reduced the PQGS premature low-level indicator penalty to less than 5 seconds. Preliminary flight data from Apollo 14 indicate that the device operated successfully. Author

N71-37842*# Cincinnati Univ., Ohio. Inst. of Space Sciences.
THE INITIAL DEVELOPMENT OF THE GENERAL NON-ISOENERGETIC COMPRESSIBLE FREE SHEAR LAYER
P. Carpenter and W. Tabakoff. Washington NASA Oct. 1971 136 p refs
(Grant NGL-36-004-014)
(NASA-CR-1828) Avail: NTIS CSCL 20D

The numerical integration of the equations governing the development of a free shear layer form arbitrary initial conditions is carried out using a modification of Dorodnitsyn's method of integral relations. The problem of the singularity at the origin is solved by splitting the domain of integration into two strips; and, also, transforming one of the dependent variables. The effects of viscous heating are taken in to consideration and Sutherland's law is used to determine coefficient of viscosity in the laminar

case. A new eddy viscosity model is introduced for the turbulent free shear layer. Results are presented showing the effects of compressibility (Mach numbers ranging from 0 to 10), and total enthalpy ratio (ranging from 0 to 5), on the development of such parameters as temperature and velocity along the dividing streamline, heat transfer and shear stress coefficients, and dividing streamline location. Author

N71-37843# Massachusetts Inst. of Tech., Cambridge. Acoustics and Vibration Lab.
ON THE GENERATION OF WALL PRESSURE FLUCTUATIONS FOR TURBULENT BOUNDARY LAYERS OVER ROUGH WALLS
Thomas E. Burton Mar. 1971 67 p refs
(Contract N00014-67-A-0204-0002)
(AD-727634; A/V-70208-4) Avail: NTIS CSCL 20/4

The study of pressure-velocity correlation in turbulent flow was extended to turbulent boundary layer flow over a roughened wall in the absence of a longitudinal pressure gradient. The results obtained are qualitatively similar to those previously measured over smooth walls. A theory is presented to partially explain the behavior of the measured correlations ig both the smooth-wall and rough-wall cases. GRA

N71-37844# Iowa Engineering Experiment Station, Ames.
DIFFUSION OF DRAG REDUCING POLYMERS IN A TURBULENT BOUNDARY LAYER
Michael Poreh (M.S. Thesis) and Kuang-Shen Hsu (M.S. Thesis) Apr. 1971 31 p refs
(Contract Nonr-1161(03))
(AD-727632; IIHR-126) Avail: NTIS CSCL 20/4

The diffusion of diluted drag reducing polymers and the effect of the diffusing polymers on the development of the boundary layer are analyzed. The analysis suggests that the diffusion rate is reduced together with the drag. However, in most practical situations the reduction in the diffusion rate is small. Polymers ejected near the wall will diffuse over the entire turbulent boundary layer within a distance of the order of 1000 boundary layer thicknesses. Author (GRA)

N71-37845# Ohio State Univ. Research Foundation, Columbus.
A THREE DIMENSIONAL HOT WIRE ANEMOMETRY TECHNIQUE EMPLOYING A SINGLE WIRE PROBE
Technical Report, Nov. 1970 - Jan. 1971
Richard E. Rosenberg Wright-Patterson AFB, Ohio ARL Mar. 1971 25 p refs
(Contract F33615-67-C-1758)
(AD-727792; ARL-71-0039) Avail: NTIS CSCL 14/2

A hot-wire technique for three dimensional velocity measurements in an unknown flow field is described. These measurements are carried out with a single-wire hot-wire probe, where the wire is attached with a certain angle to the probe stem axis. Author (GRA)

N71-37846# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SELF-SIMULATING SOLUTIONS IN TRANSONIC GAS DYNAMICS
L.A. Chernov 29 Mar. 1971 51 p refs Transl. into ENGLISH from the publ. "Transzvukovyye Techeniya Gaza. Sbornik Statey" Saratov, Izd-vo Saratovskogo Univ., 1964 p 63-100
(AD-727194; FTD-HT-23-36-71) Avail: NTIS CSCL 20/4

Some general properties of self-similar solutions of transonic flows, both plane and axisymmetric, are investigated in detail. A given governing differential equation is rewritten, using the given Legendre transformation. Conditions for a similar solution are obtained from a given equation where it is shown that the functions g and q must have a given form. The main analysis is carried out in the (s, t) plane instead of in the hodograph plane. It is shown that a given curve can be determined if a given function is known. A complete description is then given of known integral curves. Self-similar solutions for three special cases are investigated. The flow inside a nozzle is considered first. The second special case is that of a local supersonic flow bounded by a shock wave from below. The third case is that of a plane transonic flow far from the surface of an object. GRA

N71-37847# Office of Naval Research, London (England).
THE 13TH BRITISH THEORETICAL MECHANICS COLLOQUIM
Alfred Banos, Jr. 24 Jun. 1971 31 p refs Conf. held at Dundee, Engl., 29 Mar. - 2 Apr. 1971
(AD-727894; ONRL-C-14-71) Avail: NTIS CSCL 20/4

The Thirteenth British Theoretical Mechanics Colloquium was held at the University of Dundee on 29 March to 2 April 1971. There were 243 registered participants of which 214 came from 37 British universities, and the remaining 29 were about equally divided between British government laboratories and foreign universities. The format of the three-day meeting included four one-hour invited lectures and 54 half-hour contributed papers, which were presented in three parallel sessions and which covered a rather wide variety of subjects. The Appendix contains the abstracts of the contributed papers as written by the authors. Author (GRA)

N71-37848# Purdue Univ., Lafayette, Ind. Project Squid Headquarters.
UNSTEADY TRANSONIC FLOWS IN TWO DIMENSIONAL CHANNELS
Thomas C. Adamson, Jr. (Michican Univ., Ann Arbor) Jun. 1971 41 p refs
(Contract N00014-67-A-0226-0008; Proj. Squid)
(AD-727641; SQUID-TR-MICH-9-PU) Avail: NTIS CSCL 20/4

A two dimensional unsteady transonic irrotational inviscid flow of a perfect gas with constant specific heats is considered. The analysis involves perturbations from a uniform sonic isentropic flow. The governing perturbation potential equations are derived for various orders of the ratio of the characteristic time associated with a temporal flow disturbance to the time taken by a sonic disturbance to traverse the transonic regime. The case where this ratio is large compared to one is studied in detail. A similarity solution involving an arbitrary function of time is found and it is shown that this solution corresponds to unsteady channel flows with either stationary or time varying wall shapes. Numerical computations are presented showing the temporal changes in flow structure as a disturbance dies out exponentially for the following typical nozzle flows: simple accelerating (Meyer) flow and flow with supersonic pockets (Taylor and limiting Taylor flow). Author (GRA)

N71-37849# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PROPERTIES OF THREE DIMENSIONAL FLUID MOTION CORRESPONDING TO AN INVARIANT TRANSFORMATION OF EULER'S EQUATIONS OF MOTION
Galina Kamenskii 18 Jun. 1971 15 p refs Transl. into ENGLISH from Studii Cercetari Matematice (Romania), v. 22, no. 5, 1970 p 693-700
(AD-727933; FTD-HC-23-312-71) Avail: NTIS CSCL 20/4

A study is given of certain properties of three-dimensional compressible fluid flows obtained by the application of an invariant transformation. The invariant transformation of the equations of three-dimensional motion for ideal compressible fluids and the continuity equation are used to determine an element of arc of a streamline. In addition, the kinetic energy of such fluid flows is calculated, as well as the pressures acting on a rigid body in a certain space. Author (GRA)

N71-37850# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
A WEAKLY SUPERSONIC FLOW AROUND THIN BODIES
S. V. Falkovich et al 12 Mar. 1971 21 p refs Transl. into ENGLISH from Transzvukovye Tech. Gaza (USSR), 1964 p 9-21
(AD-727854; FTD-HT-23-31-71) Avail: NTIS CSCL 20/4

A two-dimensional steady gas flow past a thin symmetrical body is studied under the assumption that the mach number at infinity is close to unity. The continuous nature of shock-wave formation during transition from sonic to supersonic flow is established mathematically. This solution also explains the 'bursts' in the values of the current function calculated by Vincenti and Wagoner. As a result of the numerical calculations, the first 20 coefficients are found and the transition to plane (x,y) is made. GRA

N71-37851# Imperial Coll. of Science and Technology, London (England). Dept. of Aeronautics.
USE OF A REFINED BOUNDARY-LAYER CALCULATION METHOD TO CALIBRATE A SIMPLE ONE
P. Bradshaw Oct. 1971 12 p refs
(IC/71/23) Avail: NTIS

A technique is described which enables refined standards of accuracy to be obtained from a simple boundary layer calculation method, over a small range of pressure distributions near the one used for calibration. The technique can be applied to multi-run problems such as parametric studies or the iterative calculation of aerofoil pressure distribution with allowance for viscous effects. Author

N71-37852# Imperial Coll. of Science and Technology, London (England). Dept. of Aeronautics.
TURBULENT SEPARATION IN HYPERSONIC FLOW
G. M. Elfstrom (Ph.D. Thesis - London Univ.) Sep. 1971 144 p refs
(IC/71/16) Avail: NTIS

Interactions between oblique shock waves and boundary layers to adequately predict performance of various aerodynamic devices used on hypersonic cruising vehicles, such as flaps, spoilers and inlets are discussed. The case of laminar shock-boundary layer interaction has been studied, both experimentally and theoretically. The existing range of shock-boundary layer interaction data for hypersonic turbulent flow is extended. A general review of previous literature pertaining to supersonic turbulent shock-boundary layer interactions is given. Shock-boundary layer interaction experiments are described. A simple model for predicting attached flow pressure distributions and incipient separation at a wedge-compression corner is presented. Author

N71-37853# Aircraft Research Association, Ltd., Bedford (England).
SOME MEASUREMENTS OF POROUS TUNNEL WALL INTERFERENCE IN THE ARA 8 FOOT BY 8 FOOT TUNNEL
E. C. Carter Sep. 1971 28 p refs
(ARA-19) Avail: NTIS

Results are presented of measurements made in a 8ft x 8ft transonic tunnel to determine the constraint and blockage corrections at subsonic Mach numbers. Corrections were determined initially for a transport type of model at Mach numbers up to 0.88. These indicate the existence of a simple upwash constraint factor invariant with Mach number and equal to 50% of the open tunnel value, a zero blockage correction, and a blockage buoyancy correction equal to 50% of the theoretical value calculated for the wall characteristics giving zero blockage. This latter 50% factor is associated with the graded porosity opposite the forward part of the model. These corrections were applied to results in the porous section obtained on a very different type of model - a large canard configuration with low drag-rise Mach number. These corrected results were compared with tests on the model in the tunnel with closed walls. Agreement in lift and drag is generally very good. Author

N71-37854# Polytechnic Inst. of Brooklyn, Farmingdale, N.Y. Dept. of Aerospace Engineering and Applied Mechanics.
A NOTE ON THE TRANSIENT BEHAVIOR OF SOME DIFFERENCE SCHEMES THAT APPROXIMATE THE NAVIER-STOKES EQUATIONS
Manuel D. Salas Jul. 1971 28 p refs
(Contract N00014-67-A-0438-0009)
(AD-728020; PIBAL-71-22) Avail: NTIS CSCL 12/1

The one-dimensional, viscous, piston driven flow is used to study numerically the transient behavior of some difference schemes which approximate the Navier-Stokes equations only in the steady state. The case presented shows a 5% error in the shock location. Author (GRA)

N71-37855# Naval Postgraduate School, Monterey, Calif.
A THEORETICAL AND EXPERIMENTAL STUDY OF THE THREE JET INTERACTION
Gerardo Hiriart Le-Bert (M.S. Thesis) Apr. 1970 132 p refs
(AD-727689) Avail: NTIS CSCL 13/7

The interaction of three jets is studied both theoretically and experimentally. The angle of deflection and the velocity and turbulence distributions were determined through the use of a hot-wire anemometer. The free-streamline theory has been applied to the determination of the jet deflection and the results so obtained were found to be in good agreement with those obtained experimentally. The study is a convincing evidence of the fact that a proper combination of inviscid flow analysis together with experimental results can provide the necessary guidance for the design of proportional amplifiers. Author (GRA)

N71-37856# General Applied Science Labs., Inc., Westbury, N.Y.
EXPERIMENTAL INVESTIGATION OF THE NEAR FLOW FIELD FOR TUBE VEHICLES Final Report
Sergio Penunzio and Daniel E. Magnus Nov. 1970 90 p refs
(Contract DOT-FR-0039)
(GASL-TR-70-749; PB-198205; FRA-RT-71-72) Avail: NTIS

The experimental results from an investigation of the near flow field for tube-vehicle systems are reported. The data were obtained from a tube-vehicle test facility which is 200 feet long and instrumented to measure vehicle drag, history of static wall pressure, and dynamic pressure. Emphasis is placed on the accurate measurement of the dynamic pressure to determine the flow velocity in front of the vehicle. A drag coefficient is defined and related to the relative Mach number and the ratio of relative flow velocity to vehicle velocity. The experimental results are correlated with an analysis of the near flow field and results from other studies. Author

N71-37857*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EXPERIMENTAL EVALUATION OF A PUMP TEST FACILITY WITH CONTROLLED PERTURBATIONS OF INLET FLOW
William Stevans and Robert J. Bieda Washington Nov. 1971 49 p refs
(NASA-TN-D-6543; E-6476) Avail: NTIS CSCL 20D

A pump test facility to experimentally investigate the relations governing the operation of a pump under periodic fluctuations of inlet pressure and flow is described. The perturbed flow entering the pump is determined by using the acoustical wave equation and accounting for the motion of the test facility. The perturbed flow leaving the pump is determined by a specially designed multihole orifice plate. The difference between the perturbed flows entering and leaving the pump was identified to be a compliance flow due to the compliance of the pump structure and the water it contained. Data establishing the validity of the measurement methods are presented. Author

N71-37858 National Lending Library for Science and Technology, Boston Spa (England).
TOWARDS THE ENLIGHTENED CHOICE OF A FLUID LOGIC CIRCUIT
D. Bouteille 1 Jun. 1971 18 p Transl. into ENGLISH from the publ. "Energie Fluide et Lubrication Hydraulique Pneumatique Asservissements" Paris, Union Franc. de Publ. Tech., Apr. 1970 p 57-63

(NLL-PORS-Trans-2727-(9022.81)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

A study of electric and fluid logic circuits was conducted. A comparative balance sheet of the circuits was constructed. The criteria for preliminary selection between fluid, electric, and electronic logic circuits are discussed. The influence of the input components of the information, information receivers, and other peripheral components is described. Author

N71-37859 Iowa State Univ. of Science and Technology, Ames.
INCOMPRESSIBLE SKEWED TURBULENT BOUNDARY LAYER ON AN END WALL OF A CURVED TWO-DIMENSIONAL DIFFUSER
Marvin Dale Smith (Ph.D. Thesis) 1970 307 p
Avail: Univ. Microfilms Order No. 70-18908

The development of the three-dimensional turbulent boundary layer in a curved diffusing passage is shown. The investigation provides data obtained in a curved diffuser with an aspect ratio of 1.5, an area ratio of 1.56, and a turning angle of 40 degrees. A hot-wire boundary layer probe was designed and a technique developed for obtaining mean velocity and angle measurements. Unsuccessful attempts were made to develop a method for obtaining turbulence data in the three-dimensional environment. This resulted in information indicating a possible discrepancy in the majority of methods for determining turbulence data with an inclined hot-wire. A fractional analysis was conducted using the continuity equation and the Navier-Stokes equations written in curvilinear coordinates. Different normalizing values were used for the variables and the result showed slight changes from two-dimensional similarity parameters. Dissert. Abstr.

N71-37880 California Univ., Berkeley.
STUDY OF THE GENERATION OF PRESSURE WAVES BY EXPLOSIVE CHEMICAL REACTIONS
Lawrence John Zajac (Ph.D Thesis) 1969 174 p
Avail: Univ. Microfilms Order No. 70-17692

The generation of pressure waves in explosive hydrogen-oxygen mixtures. The influence of the initial state on the generation of flow is examined, especially with respect to temperatures and pressures near the extrapolated second explosion limit. The flow is assumed to be one-dimensional, but, within this restriction, spherical and cylindrical, as well as plane-symmetrical fields, are included. The analysis treats a conceptual model where the reactive gas mixture is contained within a small regime, the reaction center, that is situated in an essentially unconfined atmosphere of nonreactive gas maintained at frozen composition corresponding to the initial conditions of the reaction center. A complete set of data on the kinetics of chain reactions are used to evaluate the resulting chemical and gas dynamic processes. This is obtained by a numerical solution of the kinetic rate equations for the chemical system, subject to thermodynamic restrictions imposed by the nonsteady gas dynamic processes of the flow field. Dissert. Abstr.

13 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; oceanography; cartography; and geodesy. For related information see also: 20 Meteorology; 29 Space Radiation; and 30 Space Sciences.

N71-37861*# Old Dominion Univ. Research Foundation, Norfolk, Va.
CLEAR WATER: AFFLUENCE, INFLUENCE, EFFLUENTS: A DESIGN FOR WATER QUALITY MANAGEMENT Summer Faculty Fellowship Program in Engineering Systems Design
Albert E. Miller, ed., J. Darrell Gibson, ed., and Richard D. Kiefer, ed. 1971 240 p refs
(Grant NGT-47-003-028)
(NASA-CR-121926) Avail: NTIS CSCL 08H

A comprehensive analysis of water pollution conditions in Virginia is presented. Subjects discussed are: (1) the societal influence on clean water, (2) treating the effluents, (3) impediments to clean water, (4) system design for clean water, and (5) control plans for water quality management. Specific application of water treatment techniques to the James River are reported. Author

N71-37862*# Michigan Univ., Ann Arbor. Infrared and Optics Lab.
WATER-DEPTH MEASUREMENT BY WAVE REFRACTION AND MULTISPECTRAL TECHNIQUES Technical Report, 1 Jul. 1969 - 30 Sep. 1970
W. L. Brown, F. C. Polcyn, A. N. Sellman, and S. R. Stewart Aug. 1971 49 p refs
(Contract NAS9-9784)
(NASA-CR-123194; WRL-31650-31-T) Avail: NTIS CSCL 20F

Two remote sensing techniques which measure water depth were investigated. One technique involves photographic observation of wave refraction phenomena and of wave length changes measured in Fourier transforms. The transforms were obtained by optical processing. Test sites near Puerto Rico and Barbadoes were used to study wave changes which occur near nonuniform bottom profiles of shallow reefs. The second technique makes use of multispectral scanner to measure radiation reflected from the ocean floor. Measurement occurs in several spectral intervals in the visible region. The depth is calculated when the ratio of signals in pairs of spectral bands is taken. The technique was tested for sloping sandy beach gradients, as well as for coral reef areas which contained a variety of materials of different reflectances. Examples of computer-generated depth maps are included. Author

N71-37863*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE ELECTRON DENSITY PROFILE IN THE D AND E REGIONS OF THE EQUATORIAL IONOSPHERE
S. Rangaswamy Oct. 1971 26 p refs Submitted for publication
(NASA-TM-X-65730; X-650-71-433) Avail: NTIS CSCL 04A

Absorption and group delay data from an equatorial station have been used to model the electron density profile in the D and E regions of the ionosphere. The model profiles were computed by numerical inversion of the propagation integrals using the generalized magnetoionic theory. The profiles so obtained are found to be in good agreement with electron density profiles at the same time at a nearby location with a rocket experiment. Author

N71-37864# Belgian Royal Observatory, Brussels.
EARTH TIDES NEWS BULLETIN, NO. 59 [MAREES TERRESTRES BULLETIN D'INFORMATIONS NO. 59]
Paul Melchior, ed. 1 Oct. 1970 69 p refs Partly in FRENCH, GERMAN and ENGLISH
Avail: NTIS

CONTENTS:

1. GRAVIMETRIC TIDES AT BOROWIEC W. Jaks p 2838 (See N71-37865 24-13)

2. ON EARTH CRUST DEFORMATIONS AT THE KONDARA STATION IN TADZHIKISTAN L. Latynina p 2839-2852 refs (See N71-37866 24-13)

3. METHODICAL QUESTIONS AND EXPERIENCES ON EARTH TIDAL MEASUREMENTS AT THE SOVIET WINTER STATION WOSTOL IN CENTRAL ANTARCTICA M. M. Schneider p 2853-2868 refs (See N71-37867 24-13)

4. GEOPHYSICAL CLASSIFICATION OF EARTH TILT M. Caputo and G. F. Panza (Ist. di Fisica) p 2869-2873 refs (See N71-37868 24-13)

5. CONSTRUCTION OF A NEW EARTH TIDAL STATION IN THE SALT MINE TIEFENORT D. Simon (Deut. Akademie der Wissenschaften zu Berlin (East Germany)) p 2874-2881 refs

(See N71-37869 24-13)

6. MILLIONTH DEGREE CENTRIGRADE PRECISION THERMOSTAT FOR GRAVIMETRIC REGISTRATION OF EARTH TIDES C. Queille and G. Clerc p 2882-2920 refs (See N71-37870 24-13)

N71-37865# Belgian Royal Observatory, Brussels.
GRAVIMETRIC TIDES AT BOROWIEC [MAREE GRAVIMETRIQUE A BOROWIEC]
Waldemar Jaks *In* Its Earth Tides News Bull., No. 59 1 Oct. 1970 p 2838 In FRENCH (See N71-37864 24-13)
Avail: NTIS

Gravimetric tides recorded for the years 1961 to 1964 by the Borowiec Astronomical Station are presented. The source of perturbations and the effects of the interior light of the gravimeter on the sensitivity of the instrument are discussed. The Lecolazet and Pertsev methods were used to determine the drift of the gravimeter. Results are given in tabular form.
Transl. by E.H.W.

N71-37866# Belgian Royal Observatory, Brussels.
ON EARTH CRUST DEFORMATIONS AT THE KONDARA STATION IN TADZHKISTAN [SUR LES DEFORMATIONS DE L'ECORCE TERRESTRE A LA STATION DE KONDARA AU TADJIKISTAN]
L. Latynina et al *In* Its Earth Tides News Bull., No. 59 1 Oct. 1970 p 2839-2852 refs Repr. from Fiz. Zemli, v. 3, 1968 p 75-84 In FRENCH (See N71-37864 24-13)
Avail: NTIS

The use of deformagraphs and extensometers for measuring the movements in horizontal earth crust deformations is discussed. The general and particular movement of a small select portion of the earth's surface are examined. Also examined is the slow drift of the instrument.
Transl. by E.H.W.

N71-37867# Belgian Royal Observatory, Brussels.
METHODICAL QUESTIONS AND EXPERIENCES ON EARTH TIDAL MEASUREMENTS AT THE SOVIET WINTER STATION WOSTOL IN CENTRAL ANTARCTICA [METHODISCHE FRAGEN UN ERFAHRUNGEN BEI ERDGEZEITENMESSUNGEN AU DER SOWJETISCHEN UBERWINTERUNGSSTATION WOSTOK IN DER ZENTRALEN AUTARKTIS]
M. Manfred Schneider *In* Its Earth Tides News Bull., No. 59 1 Oct. 1970 p 2853-2868 refs In GERMAN (See N71-37864 24-13)
Avail: NTIS

Earth tide measurements by gravimeter and horizontal pendulum are reported from a geophysical ground station in the Antarctic inzerior for the winter 1968. Optimal instrument performance was obtained by efficient insulation methods and by steady uniform of power to the measuring devices. Registered amplitudes of the most important partial tides observed at high altitudes are shown in graphs.
Transl. by G.G.

N71-37868# Bologna Univ. (Italy). Istituto di Fisica.
GEOPHYSICAL CLASSIFICATION OF EARTH TILT
M. Caputo and G. F. Panza *In* Belgium Roy. Obs. Earth Tides News Bull., No. 59 1 Oct. 1970 p 2869-2873 refs (See N71-37864 24-13)
Avail: NTIS

A review of the research made in connection with the effects of meteorological perturbations on earth crust tides are discussed. Proposals are made for international cooperation by tide stations of the world.
Author

N71-37869# Deutsche Akademie der Wissenschaften zu Berlin (East Germany).
CONSTRUCTION OF A NEW EARTH TIDAL STATION IN THE SALT MINE TIEFENORT [AUFBAU EINER NEUEN ERDGEZEITENSTATION IM SALZBERGWERK TIEFENORT]
Dietrich Simon *In* Belgium Roy. Obs. Earth Tides News Bull., No. 59 1 Oct. 1970 p 2874-2881 refs In GERMAN (See N71-37864 24-13)
Avail: NTIS

A new climatological station is described that places its clinometers and gravimeters in hermetically sealed chambers to prevent barometric and thermal side effects on the accuracy of earth crust tidal registrations. The instruments are remote controlled from outside the chamber walls.
Transl. by G.G.

N71-37870# Belgian Royal Observatory, Brussels.
MILLIONTH DEGREE CENTIGRADE PRECISION THERMOSTAT FOR GRAVIMETRIC REGISTRATION OF EARTH TIDES [THERMOSTAT DE PRECISION AU MILLIEME DE DEGRE CENTIGRADE POUR GRAVIMETRE D'ENREGISTREMENT DE LA MAREE TERRESTRE]
C. Queille and G. Clerc *In its* Earth Tides News Bull., No. 59 1 Oct. 1970 p 2882-2920 refs In FRENCH (See N71-37864 24-13)
Avail: NTIS

A high precision thermostat for gravimetric recording of earth tide amplitudes is discussed. Precision was tested by comparing theoretical and experimental earth tides. A precision of 10 to the minus 7th power gal was obtained.
Transl. by E.H.W.

N71-37871# Belgian Royal Observatory, Brussels.
EARTH TIDES NEWS BULLETIN, NO. 60 [MAREES TERRESTRES BULLETIN D'INFORMATIONS, NO. 60]
Paul Melchior 25 Feb. 1971 61 p refs Partly in FRENCH, GERMAN, and ENGLISH
Avail: NTIS

CONTENTS:

1. EARTH SURFACE TIDE TILT OBSERVATIONS IN BOREHOLES AROUND MOSCOW A. Ye. Ostrovskiy et al p 2923-2933 refs (See N71-37872 24-13)

2. THE ASKANIA BOREHOLE TILT PENDULUM (TIDAL PENDULUM) OF A. GRAF AT THE TEST STATION ZELLERFELD-MUEHLENHOEHE D. Flach and O. Rosenbach (Tech. Univ., Clausthal-Zellerfeld, West Germany) p 2934-2943 refs (See N71-37873 24-13)

3. STUDIES WITH THE ASKANIA BOREHOLE PENDULUM (TIDAL PENDULUM) OF A. GRAF AT THE TEST STATION ZELLERFELD-MUEHLENHOEHE, PART 1 D. Flach, O. Rosenbach, and H. Wilhelm (Tech. Univ., Clausthal-Zellerfeld, West Germany) p 2944-2954 refs (See N71-37874 24-13)

4. THE OBSERVATIONS OF TIDAL TILTS AND GRAVITATIONAL FORCE FLUCTUATIONS AT SIMFEROPOL Z. N. Aksentyeva et al p 2955-2961 refs (See N71-37875 24-13)

5. SOME PECULIAR MOTIONS OF HORIZONTAL PENDULUMS WT THE EARTH TIDAL STATION SIMFEROPOL O. V. Chuprunova p 2962-2966 refs (See N71-37876 24-13)

6. CLINOMETRIC OBSERVATIONS AT VELIKIYE BUDISHCHA P. S. Matveyev, I. D. Bogdan, and G. M. Lissenko (Akademiya Nauk USSR, Poltava) p 2967-2973 refs (See N71-37877 24-13)

7. ON THE INFLUENCE OF AN INDIRECT EFFECT ON CLINOMETRIC OBSERVATION RESULTS B. P. Pertsev p 2974-2978 refs (See N71-37878 24-13)

8. THE TIDES IN THE ELASTIC ROTATING EARTH WITH A LIQUID CORE M. S. Molodenskiy p 2979-2987 refs (See N71-37879 24-13)

9. REGISTRATION OF TIDAL VARIATIONS THROUGH GRAVITATIONAL FORCE ACCELERATION BY PHOTOELECTRIC REGISTRATION WITH STATIC QUARTZ GRAVIMETER AT KRASNAYA PAKHRA D. G. Gridniyev p 2988-2998 refs (See N71-37880 24-13)

N71-37872# Belgian Royal Observatory, Brussels.
EARTH SURFACE TIDE TILT OBSERVATIONS IN BOREHOLES AROUND MOSCOW [INCLINAISONS DE MAREES DE LA SURFACE DE LA TERRE D'APRES LES

OBSERVATIONS DANS LES PUITS VOISINS DE MOSCOW]
B. Ye. Ostrovskiy et al *In its* Earth Tides News Bull., No. 60 25 Feb. 1971 p 2923-2933 refs Transl. into FRENCH from Russian report In FRENCH (See N71-37871 24-13)
Avail: NTIS

Earth tilt observations were made at two stations south of Moscow. Tables of data are presented. Transl. by K.P.D.

N71-37873# Technische Universitaet, Clausthal-Zellerfeld (West Germany). Inst. fuer Geophysik.
THE ASKANIA BOREHOLE TILT PENDULUM (TIDAL PENDULUM) OF A. GRAF AT THE TEST STATION ZELLERFELD-MUEHLENHOEHE [DER ASKANIA BOHRL OCH-NEIGUNGSMESSER (GEZEITENPENDEL) NACH A. GRAF AUF DER TEST-STATION ZELLERFELD-MUEHLENH OEHE]
Dieter Flech and Otto Rosenbach *In* Belgian Roy. Obs. Earth Tides News Bull., No. 60 25 Feb. 1971 p 2934-2943 refs In GERMAN (See N71-37871 24-13)
Avail: NTIS

The installation of a borehole tilt pendulum at a test station is described. The vertical pendulum is able to continuously register smallest tides in the earth crust when positioned in special chambers below the earth surface. Boreholes are selected so that they provide stability and thermal constants for the measuring instrument. Transl. by G.G.

N71-37874# Technische Universitaet, Clausthal-Zellerfeld (West Germany). Inst. fuer Geophysik.
STUDIES WITH THE ASKANIA BOREHOLE PUNDULUM (TIDAL PENDULUM) OF A. GRAF AT THE TEST STATION ZELLERFELD-MUEHLENHOEHE, PART 1 [UNTERSUCHUN-GEN DES ASKANIA BOHRLOCH-NEIGUNGSMESSERS (GEZEITENPENDEL) NACH A. GRAF AUF DER TEST-STATION ZELLERFELD-MUEHLENHOEHE]
Dieter Flech, Otto Rosenbach, and Helmut Wilhelm (Univ.-Sternwarte Goettingen) *In* Belgian Roy. Obs. Earth Tides News Bull., No. 60 25 Feb. 1971 p 2944-2954 refs In GERMAN (See N71-37871 24-13)
Avail: NTIS

The performance of borehole tilt pendulums is evaluated by comparing obtained earth tide registrations with theoretical values. Observed differences in the NS-registration towards the positive in the southern direction, and for the EW-component towards the west are attributed to geodynamic differences in ground positions as well as to instrumental differences.
Transl. by G.G.

N71-37875# Belgian Royal Observatory, Brussels.
THE OBSERVATIONS OF TIDAL TILTS AND GRAVITATIONAL FORCE FLUCTUATIONS AT SIMFEROPOL [LES OBSERVATIONS SUR LES INCLINAISONS DE MAREES ET LES VARIATIONS DE LA FORCE DE PESANTEUR A SIMFEROPOL]
Z. N. Aksentyeva et al *In its* Earth Tides News Bull., No. 60 25 Feb. 1971 p 2955-2961 refs Transl. into FRENCH from Geofiz. Astron., Inform. Byull. (Kiev), no. 11, 1967 p 169-175 In FRENCH (See N71-37871 24-13)
Avail: NTIS

Earth tide observations using horizontal pendulums and a gravimeter are given for the period 1964-1965. Harmonic analysis was used to reduce the data. Transl. by K.P.D.

N71-37876# Belgian Royal Observatory, Brussels.
SOME PECULIAR MOTIONS OF HORIZONTAL PENDULUMS AT THE EARTH TIDAL STATION SIMFEROPOL [QUELQUES PARTICULARITES DANS LE MOUVEMENT DES PENDULES HORIZONTAUX DANS LA STATION DES MAREES TERRESTRES SIMFEROPOL]
O. V. Chuprunova *In its* Earth Tides News Bull., No. 60 25 Feb. 1971 p 2962-2966 refs Transl. into FRENCH from Geofiz. Astron., Inform. Byull. (Kiev) p 186 In FRENCH (See N71-37871 24-13)
Avail: NTIS

Variations in pendulum movement before earthquakes and the daily velocity of motion of the instrument base are discussed. Transl. by K.P.D.

N71-37877# Akademiya Nauk URSR, Poltava.
CLINOMETRIC OBSERVATIONS AT VELIKIYE BUDISHCHA [OBSERVATIONS CLINOMETRIQUES A VELIKIE BOUDICHA]
P. S. Matveyev, I. D. Bogdan, and G. M. Lisenko *In* Belgian Roy. Obs. Earth Tides News Bull., No. 60 25 Feb. 1971 p 2967-2973 refs In FRENCH (See N71-37871 24-13)
Avail: NTIS

Clinometric measurements for 1965-1966 are discussed. The data were recorded by a parallel battery of instruments at a depth of 12.4 m. Transl. by K.P.D.

N71-37878# Belgian Royal Observatory, Brussels.
ON THE INFLUENCE OF AN INDIRECT EFFECT ON CLINOMETRIC OBSERVATION RESULTS [SUR L'INFLUEN-CE DE L'EFFET INDIRECT SUR LES RESULTATS DES OBSERVATIONS CLINOMETRIQUES]
B. P. Pertsev *In its* Earth Tides News Bull., No. 60 25 Feb. 1971 p 2974-2978 refs Transl. into FRENCH from Proceeding of the Intern. Symp. on Inclination Meas. (Leningrad), 1968 p 182-186 In FRENCH (See N71-37871 24-13)
Avail: NTIS

The indirect influence of oceanic tides on earth tides is discussed. Corrections for clinometric data were calculated. Resultant calculations for the principal semidiurnal lunar wave are presented for NS and EW components. Transl. by K.P.D.

N71-37879# Belgian Royal Observatory, Brussels.
THE TIDES IN THE ELASTIC ROTATING EARTH WITH A LIQUID CORE [LES MAREES DANS LA TERRE ELASTIQUE EN ROTATION AVEC UN NOYAU LIQUIDE]
M. S. Molodenskiy *In its* Earth Tides News Bull., No. 60 25 Feb. 1971 p 2979-2987 refs Transl. into FRENCH from Russian report In FRENCH (See N71-37871 24-13)
Avail: NTIS

Rotation of the earth influences diurnal tides in the liquid core. Equations of motion are developed, based on equipotential surfaces of equal density. Initial tensions have a hydrostatic character. Transl. by K.P.D.

N71-37880# Belgian Royal Observatory, Brussels.
REGISTRATION OF TIDAL VARIATIONS THROUGH GRAVITATIONAL FORCE ACCELERATION BY PHOTO-ELECTRIC REGISTRATION WITH STATIC QUARTZ GRAVIMETER AT KRASNAYA PAKHRA [ENREGISTRE-MENT DES VARIATIONS DE MAREES DE L'ACCELERAT-ION DE LA FORCE DE PESANTEUR A KRASNAIA PAKHRA PAR LE GRAVIMETRE STATIQUE EN QUARTZ A ENREGISTREMENT PHOTOELECTRIQUE]
D. G. Gridniyev *In its* Earth Tides News Bull., No. 60 25 Feb. 1971 p 2988-2998 refs Transl. into FRENCH from Russian report In FRENCH (See N71-37871 24-13)
Avail: NTIS

Gravitational tide variations were recorded in a cave at Krasnaya Pakhra. The experimental gravimeter model used is described. Tables of data are included. Transl. by K.P.D.

N71-37881# Soil Conservation Service, Denver, Colo.
WATER SUPPLY OUTLOOK FOR COLORADO AND NEW MEXICO, 15 MAY, 1 JUNE 1971 AND SPECIAL MEASUREMENTS
Jack N. Weshichek and Ronald E. Moreland 1 Jun. 1971 6 p
Avail: NTIS

Detailed data on snow course and soil moisture measurements are presented for mountainous areas of Colorado and

New Mexico. Other data on reservoir storage, summaries of precipitation, current streamflow, and soil moisture conditions at valley elevations are also included. Tabular data are presented for surveys conducted January 1, May 15, and June 1, 1971.
A.L.

N71-37882# Environmental Research Corp., Las Vegas, Nev.
COVARIANCE ANALYSIS OF RESPONSE SPECTRA
Robert D. Lynch May 1971 66 p refs Sponsored by AEC (NVO-1163-TM-24) Avail: NTIS

Pseudo relative velocity response spectra, derived from 26 horizontal components of ground motion at 13 recording stations, are analyzed using a statistical model known as analysis of covariance. The analysis generates, as a function of period, yield scaling exponents and sigma values which are characteristic of the total data sample. The statistically determined yield scaling exponents agree well with theoretically determined exponents. Individual amplitude coefficients for each station-component data sample are determined. These coefficients reflect the characteristics of the transmission path between the source and recording stations. Data are presented which demonstrate that considerable variability in the mean spectrum can be attributed to the transmission path. Author (NSA)

N71-37883# Max-Planck-Institut fur Aeronomie, Lindau Uber Northeim (West Germany).
FUTURE APPLICATION OF SATELLITE BEACON EXPERIMENTS
W. Dieminger and G. K. Hartmann, eds. Nov. 1970 309 p refs Proc. of the Symp. held at Lindau, West Ger., 2-4 Jun. 1970; sponsored jointly by Max-Planck-Inst. fuer Aeronomie and Deut. Ges. fuer Ortung und Navigation
Avail: NTIS HC $6.00/MF $0.95

Conference papers on applications of satellite radio beacons for ionospheric electron content determination and navigation are presented. For individual titles, see N71-37884 through N71-37920.

N71-37884# Air Force Cambridge Research Labs., Bedford, Mass.
ON THE SPECIFICATION OF TOTAL ELECTRON CONTENT
R. S. Allen and J. A. Klobuchar *In* Max-Planck-Inst. fuer Aeronomie Future Appl. of Satellite Beacon Expt. Nov. 1970 5 p (See N71-37883 24-13)
Avail: NTIS HC $6.00/MF $0.95

A time delay error in satellite navigation systems is caused by ionospheric electrons. This time delay error is proportional to the total electron content. Corrections for this delay are proposed by using a specification model based on one parameter, a nearby measurement of the density of the peak of the F-region. ESRO

N71-37885# Air Force Cambridge Research Labs., Bedford, Mass.
ON THE TEMPORAL VARIATION OF SCINTILLATION
R. S. Allen and J. Aarons *In* Max-Planck-Inst. fuer Aeronomie Future Appl. of Satellite Beacon Expt. Nov. 1970 5 p (See N71-37883 24-13)
Avail: NTIS HC $6.00/MF $0.95

Some of the simpler aspects of the temporal behavior of scintillations at a mid-latitude station are discussed. The observations are based on the 137 MHz telemetry beacons of Canary Bird (Intelsat 2) and of ATS-3. ESRO

N71-37886# Naval Weapons Lab., Dahlgren, Va.
SATELLITE TRANSMISSIONS AVAILABLE FOR IONOSPHERIC RESEARCH
R. J. Anderle *In* Max-Planck-Inst. fuer Aeronomie Future Appl. of Satellite Beacon Expt. Nov. 1970 8 p refs (See N71-37883 24-13)
Avail: NTIS HC $6.00/MF $0.95

A number of satellites, included in the naval navigation satellite system, transmitting on a pair of highly stable coherent frequencies, were used for geodetic studies. Frequencies and orbital elements for those satellites still functioning are provided for ionospheric research. ESRO

N71-37887# Laboratoire de Radioelectricite, Rennes (France).
DETERMINATION OF TOTAL ELECTRON CONTENT FROM IONOSPHERIC DOPPLER SHIFT MEASUREMENTS
L. E. Bertel *In* Max-Planck-Inst. fuer Aeronomie Future Appl. of Satellite Beacon Expt. Nov. 1970 8 p refs (See N71-37883 24-13)
Avail: NTIS HC $6.00/MF $0.95

The differential ionospheric Doppler strip was measured, affecting the radio frequency transmissions from satellites. This material is used to deduce data on significant geophysical parameters, especially the total electron content. Results are compared with Faraday recordings. ESRO

N71-37888*# Stanford Univ., Calif. Lab. of Radioscience.
COLUMNAR ELECTRON CONTENT UP TO THE PLASMASPHERE
O. G. Almeida and A. V. da Rosa *In* Max-Planck-Inst. fuer Aeronomie Future Appl. of Satellite Beacon Expt. Nov. 1970 4 p refs (See N71-37883 24-13)
(Contract NAS5-10102)
Avail: NTIS HC $6.00/MF $0.95 CSCL 04A

Up to recently no direct determination was made of the columnar electron content of the plasmasphere up to the plasmapause. ATS-3 phase-path/Faraday rotation measurements are discussed, which make determination of total electron content possible, in conjuction with other measurements. ESRO

N71-37889# Stanford Univ., Calif. Lab. for Radioscience.
SIGNIFICANCE OF COLUMNAR ELECTRON CONTENT MEASUREMENTS
A. V. da Rosa *In* Max-Planck-Inst. fuer Aeronomie Future Appl. of Satellite Beacon Expt. Nov. 1970 7 p refs (See N71-37883 24-13)
Avail: NTIS HC $6.00/MF $0.95

Columnar electron content data are available from geostationary satellites with excellent time resolution and at low cost. The significance of content measurements for ionospheric science, engineering applications, and developing countries is pointed out. ESRO

N71-37890# Stanford Univ., Calif. Lab. for Radioscience.
COLUMNAR ELECTRON CONTENT ANALYSIS PROGRAMS
A. V. da Rosa *In* Max-Planck-Inst. fuer Aeronomie Future Appl. of Satellite Beacon Expt. Nov. 1970 20 p (See N71-37883 24-13)
Avail: NTIS HC $6.00/MF $0.95

The basic data used in the analysis of columnar electron content are the Faraday rotation anglo-US time tabulations contained in the Faraday tapes. Two programs are used to process these data and to generate processed data for further analysis (ionospheric statistical abstracts and mean electron content values). Four statistical analysis programs, plot programs, and a tabulation program are described. ESRO

N71-37891# Cologne Univ. (West Germany). Inst. for Geophysics and Meteorology.
AN ANALYSIS OF THE SEMIANNUAL VARIATION OF THE IONOSPHERIC ELECTRON CONTENT
A. Ebel *In* Max-Planck-Inst. fuer Aeronomie Future Appl. of Satellite Beacon Expt. Nov. 1970 4 p refs (See N71-37883 24-13)
Avail: NTIS HC $6.00/MF $0.95

Since 1958 several series of electron content observations, made at different stations by means of different satellite and different methods during different periods, are available. These measurements are analyzed with respect to the semi-annual

variation of the electron content. Most series of observations clearly show this variation. ESRO

N71-37892# Hamburg Univ. (West Germany). Inst. fuer Meteorologie und Radiometeorologie.
TROPOSPHERIC EFFECTS ON RADIO WAVE PROPAGATION
G. Fengler and Fengler, C. *In* Max-Planck-Inst. fuer Aeronomie Future Appl. of Satellite Beacon Expt. Nov. 1970 4 p (See N71-37883 24-13)
Avail: NTIS HC $6.00/MF $0.95

The influence of tropospheric composition on the refraction of electromagnetic wave is shown, together with other phenomena. Special attention is given to tropospheric effects on satellite-to-ground communication. ESRO

N71-37893# Standard Electrik Lorenz A. G., Stuttgart (West Germany).
TIME DISSEMINATION BY SATELLITES c21
H. C. Freiesleben *In* Max-Planck-Inst. fuer Aeronomie Future Appl. of Satellite Beacon Expt. Nov. 1970 3 p (See N71-37883 24-13)
Avail: NTIS HC $6.00/MF $0.95

The synchronization of clocks, used in navigation and collision avoidance, by time signals from satellites is proposed. ESRO

N71-37894# Warsaw Univ. (Poland). Dept. of Radio- and Television Technics.
A SYSTEM FOR DIRECT MEASUREMENT OF THE DIFFERENTIAL DOPPLER FREQUENCY c07
A. J. Fiok *In* Max-Planck-Inst. fuer Aeronomie Future Appl. of Satellite Beacon Expt. Nov. 1970 6 p (See N71-37883 24-13)
Avail: NTIS HC $6.00/MF $0.95

Receiving equipment for a direct measurement of the differential Doppler frequency of satellite transmissions is presented. The equipment has three channels, two of which are used for differential Doppler frequency measurements, and one for recording of Faraday rotation. ESRO

N71-37895# Stanford Research Inst., Menlo Park, Calif. Radio Physics Lab.
ON THE SECOND-DIFFERENCE OF PHASE-SHIFT METHOD FOR MEASURING INTEGRATED ELECTRON DENSITY
A. A. Burns and E. J. Fremouw *In* Max-Planck-Inst. fuer Aeronomie Future Appl. of Satellite Beacon Expt. Nov. 1970 7 p (See N71-37883 24-13)
Avail: NTIS HC $6.00/MF $0.95

For a high frequency signal traversing an ionized region, the second-difference of the phase shift as a function of frequency is proportional to the integrated electron density along the propagation path. The concept of this method is presented, together with the applications of this technique. ESRO

N71-37896# Deutsche Lufthansa Aktiengesellschaft, Hamburg (West Germany).
PROBLEMS OF AIR NAVIGATION c21
J. P. Hach *In* Max-Planck-Inst. fuer Aeronomie Future Appl. of Satellite Beacon Expt. Nov. 1970 6 p (See N71-37883 24-13)
Avail: NTIS HC $6.00/MF $0.95

Problems in air navigation from the airline operations point of view are presented. Aids to final approach and landing, short distance aids, and long distance aids are also discussed. ESRO

N71-37897# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany).
RECEIVING EQUIPMENT FOR NWL-SATELLITES c07
Helge Haensel *In* Max-Planck-Inst. fuer Aeronomie Future Appl. of Satellite Beacon Expt. Nov. 1970 6 p refs (See N71-37883 24-13)
Avail: NTIS HC $6.00/MF $0.95

Receiving equipment, for the beacon transmissions of Naval Weapons Laboratory transit satellites, on the frequencies 150 and 400 MHz, was installed at Braunschweig (Germany) to receive both frequencies simultaneously and record the Doppler effect. The equipment is described without considering the fundamentals of the Doppler effect. The receiving channels for the single frequencies are identical, apart from antennas, receivers, and reference frequencies. The functioning of the equipment is discussed for the 150 MHz channel. The antenna is a ground plane antenna, with preamplifier, and the reference signal is coupled in at the antenna connector parallel to the satellite signal by a capacitor probe. In order to improve signal-to-noise ratio, a tracking filter or a phase locked loop is employed. ESRO

N71-37898# Lancaster Univ. (England). Dept. of Environmental Sciences.
ATS-F: OBSERVATIONAL OPPORTUNITIES
J. K. Hargreaves *In* Max-Planck-Inst. fuer Aeronomie Future Appl. of Satellite Beacon Expt. Nov. 1970 9 p refs (See N71-37883 24-13)
Avail: NTIS HC $6.00/MF $0.95

The thinking behind the ATS-F beacon specifications is summarized, and an attempt is made to set down the observational opportunities that the beacon should provide, mainly in ionospheric research. ESRO

N71-37899# Max-Planck-Institut fur Aeronomie, Lindau Uber Northeim (West Germany). Abteilung fuer Weltraumphysik.
PROPOSAL FOR A NEW STYLE BEACON EXPERIMENT IN ORDER TO DETERMINE INTEGRAL Nds FOR THE IONOSPHERE AND MAGNETOSPHERE
W. Dieminger, G. K. Hartmann, G. Schmidt, and J. P. Schoedel *In its* Future Appl. of Satellite Beacon Expt. Nov. 1970 8 p refs Sponsored by Bundesmin. fuer Bildung und Wiss. (See N71-37883 24-13)
Avail: NTIS HC $6.00/MF $0.95

The measuring equipment is presented for a method based on the Faraday effect and the Doppler effect, in which the beacon frequency is slowly shifted from 138 MHz to 137.5 MHz and back. An alternative combined phase and group delay measuring device are also described, and it is shown how the magnetospheric electron content may be determined. ESRO

N71-37900# University Coll. of Wales, Aberystwyth.
A LOW ANGLE PROPAGATION EFFECT OF SATELLITE TRANSMISSIONS c07
L. Kersley and K. J. Edwards *In* Max-Planck-Inst. fuer Aeronomie Future Appl. of Satellite Beacon Expt. Nov. 1970 7 p refs (See N71-37883 24-13)
Avail: NTIS HC $6.00/MF $0.95

Characteristic low angle enhancements of signal strength observed at Aberystwyth, called tail-bursts, are investigated. An attempt is made to determine whether they are of tropospheric or ionospheric origin. ESRO

N71-37901# National Physical Lab., New Delhi (India).
GEOPHYSICAL IMPLICATIONS OF ELECTRON CONTENT MEASUREMENTS IN DELHI
A. P. Mitra, T. R. Tyagi, S. B. S. Sarma, and M. C. Sharma *In* Max-Planck-Inst. fuer Aeronomie Future Appl. of Satellite Beacon Expt. Nov. 1970 7 p (See N71-37883 24-13)
Avail: NTIS HC $3.00/MF $0.95

The following geophysical results of total electron content (TEC) recordings by Faraday rotation experiments and riometer F-region absorption are presented: (1) From the rate of growth of TEC at sunrise, the integrated electron production rate (Q) is obtained over a wide range of solar activity. (2) Q is analysed for summer-winter variations. (3) The ratio TEC and riometer values

leads to conclusions regarding diurnal variations of electron temperature. (4) Sudden enhancements of TEC and riometer values are analyzed. ESRO

N71-37902# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Flugfunk und Mikrowellen.
REPORT ON ZDBS (ZENTRALSTATION DES DEUTSCHEN BODENSYSTEMS) c11
H. Oettl *In* Max-Planck-Inst. fuer Aeronomies Future Appl. of Satellite Beacon Expt. Nov. 1970 7 p refs (See N71-37883 24-13)
Avail: NTIS HC $3.00/MF $0.95

ZDBS (Zentralstation des Deutschen Bodensystems) is a ground station for satellite data acquisition, tracking, and telecommand. Receiving frequency band is 136-138 MHz, and transmitting band is 147-156 MHz. A block diagram of the station layout is given, together with some notes on its technical performance and possible extensions. ESRO

N71-37903# Kiruna Geophysical Observatory (Sweden).
LOW ELEVATION OBSERVATIONS OF THE EARLY BIRD GEOSTATIONARY SATELLITE c07
Sixten Olsson *In* Max-Planck-Inst. fuer Aeronomie Future Appl. of Satellite Beacon Expt. Nov. 1970 11 p (See N71-37883 24-13)
Avail: NTIS HC $3.00/MF $0.95

The 136.44 MHz transmission from the Early Bird geostationary satellite was recorded from November 1969 at Kiruna (Sweden). Recordings were made using a Titheridge-type polarimeter and a rotating antenna with induction coupling. The results show the influence of magnetic activity. ESRO

N71-37904# Paris Univ. (France). Lab. de Physique de l'Atmosphere.
CORRECTION OF THE IONOSPHERIC ERROR IN DISTANCE MEASUREMENTS c21
R. Hanbeba and J. Paper-Lepine *In* Max-Planck-Inst. fuer Aeronomie Future Appl. of Satellite Beacon Expt. Nov. 1970 11 p refs (See N71-37883 24-13)
Avail: NTIS HC $6.00/MF $0.95

The ionsphere sets a limit to the accurate application of artificial satellites to communication and navigation problems. Errors are introduced by the distribution of ionspheric electron density. The correction of these errors by simultaneous computation of distance and total oblique electron content is proposed. ESRO

N71-37905# Consiglio Nazionale delle Ricerche, Florence (Italy). Ist. di Ricerca sulle Onde Elettromagnetiche
IONOSPHERIC RESEARCH WITH PROPAGATION EXPERIMENT FROM SATELLITE OUT OF THE STATION HORIZON c07
P. F. Pellegrini *In* Max-Planck-Inst. fuer Aeronomie Future Appl. of Satellite Beacon Expt. Nov. 1970 12 p refs (See N71-37883 24-13)
Avail: NTIS HC $3.00/MF $0.95

Beyond-the-horizon ionospheric propagation experiments are surveyed. After a brief presentation of some results obtained through the San Marco 2 experiment (1968-1970), the characteristics of a future long range propagation experiment are described. ESRO

N71-37906# Physical Research Lab., Ahmedabad (India).
IONOSPHERIC ELECTRON CONTENT MEASUREMENTS AT AHMEDABAD DURING HALF A SOLAR CYCLE
R. G. Rastogi and R. P. Sharma *In* Max-Planck-Inst. fuer Aeronomie Future Appl. of Satellite Beacon Expt. Nov. 1970 4 p (See N71-37883 24-13)
Avail: NTIS HC $3.00/MF $0.95

The results of total electron content derived from Faraday rotation of beacon signals transmitted by S-66 satellites at Ahmedabad (India) for the period November 1964 through April 1969 are discussed. They are compared with corresponding data of maximum electron density, height of peak ionization, equivalent slab thickness, and the solar flux on 10.7 cm wave. ESRO

N71-37907# Lowell Technological Inst. Research Foundation, Mass.
DIFFERENTIAL REFRACTION MEASUREMENT FOR MONITORING THE COLUMNAR ELECTRON CONTENT
K. Bibl and B. W. Reinisch *In* Max-Planck-Inst. fuer Aeronomie Future Appl. of Satellite Beacon Expt. Nov. 1970 9 p ref (See N71-37883 24-13)
(Contract F19628-68-C-0259)
Avail: NTIS HC $3.00/MF $0.95

Deviation of the ray from a straight line which connects satellite and receiving antenna is of minor significance when the second-order dispersive Doppler and Faraday effects are calculated. This deviation is measured by monitoring the S-66's 20 MHz signal with an array of three antennas placed at the corners of an isoceles with 600 m sidelines. The signal phases at two of the antennas with respect to the third are measured. ESRO

N71-37908# Lowell Technological Inst. Research Foundation, Mass.
SECOND-ORDER PHASE PATH CALCULATIONS FOR TRANSIONOSPHERIC PROPAGATION
B. W. Reinisch *In* Max-Planck-Inst. fuer Aeronomie Future Appl. of Satellite Beacon Expt. Nov. 1970 6 p refs (See N71-37883 24-13)
(Contract F19628-C-0259)
Avail: NTIS HC $3.00/MF $0.95

Phase path differences for the Faraday rotation and dispersive Doppler shift are calculated to second order in X and Y taking into consideration refraction, path splitting, and curvature of the ionosphere. ESRO

N71-37909# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany).
THE INFLUENCE OF ATMOSPHERE ON THE ACCURACY OF A SATELLITE TRACKING SYSTEM c07
P. Edenhofer, D. Giesner, and V. Stein *In* Max-Planck-Inst. fuer Aeronomie Future Appl. of Satellite Beacon Expt. Nov. 1970 11 p refs (See N71-37883 24-13)
Avail: NTIS HC $3.00/MF $0.95

It is shown that tropospheric influence can be described by assuming an exponential refractivity profile. The predicted ionospheric profile needs to be corrected by measuring the electron content with radiated waves from the tracked satellite. Some mathematical procedures are developed for computation of the atmospheric refractivity with known propagation errors. ESRO

N71-37910# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE IONOSPHERIC ELECTRON CONTENT AS DETERMINED FROM FARADAY ROTATION MEASUREMENTS OF AN EARTH SATELLITE AND DEEP SPACE PROBE
B. D. L. Mulhall and C. T. Stelzried *In* Max-Planck-Inst. fuer Aeronomie Future Appl. of Satellite Beacon Expt. Nov. 1970 10 p (See N71-37883 24-13)
Avail: NTIS HC $3.00/MF $0.95

Measurements of the earth's ionosphere were used to calibrate radio navigation data for deep space probes to improve orbit determination. To evaluate the accuracy, comparison between Faraday rotation measurements of ionospheric electron density from polarimeter monitoring of Pioneer-7 Deep Space Probe and ATS-1 satellite beacon is discussed. ESRO

N71-37911# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
APPLICATION OF SATELLITE BEACON IONOSPHERIC DATA TO SOLAR CORONA FARADAY ROTATION

MEASUREMENTS c29
Charles T. Stelzried *In* Max-Planck-Inst. fuer Aeronomie Future Appl. of Satellite Beacon Expt. Nov. 1970 5 p See N71-37883 24-13)
Avail: NTIS HC $3.00/MF $0.95

Data obtained from Faraday rotation measurements through the earth's ionosphere between ATS 1 and Goldstone Venus station, are used to correct Pioneer 6 solar corona Faraday rotation measurements. The measurement results are interpreted with a theoretical model of the solar corona. ESRO

N71-37912# Max-Planck-Institut fur Aeronomie, Lindau Uber Northeim (West Germany).
ON THE POSSIBILITY OF EVALUATING THE HYDROGEN CONCENTRATION IN THE UPPER ATMOSPHERE BY COMPARING THE BOTTOMSIDE AND TOPSIDE ELECTRON CONTENTS
P. Stubbe *In its* Future Appl. of Satellite Beacon Expt. Nov. 1970 7 p refs (See N71-37883 24-13)
Avail: NTIS HC $3.00/MF $0.95

The atomic hydrogen concentration in the upper atmosphere is determined theoretically by simultaneous solution of the coupled continuity equations, thermal equations, etc. The ratio of the topside to bottomside electron content, to be derived from Doppler satellite measurements and ionograms, is used for the computation. ESRO

N71-37913# Max-Planck-Institut fur Aeronomie, Lindau Uber Northeim (West Germany). Abteilung Weltraumphysik.
THE USE OF THE US-NAVY-NAVIGATION SATELLITE SYSTEM (NNSS) FOR THE DETERMINATION OF THE IONOSPHERIC ELECTRON CONTENT UP TO THE HEIGHT OF 1100 km
G. Schmidt *In its* Future Appl. of Satellite Beacon Expt. Nov. 1970 9 p (See N71-37883 24-13)
Avail: NTIS HC $3.00/MF $0.95

Specifications of the satellites, transmitting at 150 and 400 MHz, and how to make use of these frequencies for Faraday rotation measurements, are described. Satellite information is sufficient for definite data reduction and needs no additional information, such as refined world maps. These results may be compared with results obtained from geostationary satellites, which enables separation of exospheric plasma. ESRO

N71-37914# Max-Planck-Institut fur Aeronomie, Lindau Uber Northeim (West Germany). Abteilung fuer Weltraumphysik.
PROPOSAL FOR A RECEIVING EQUIPMENT SUITABLE FOR RADIO SIGNALS OF THE GEOSTATIONARY SATELLITE ATS-F FOR A DETERMINATION OF THE TOTAL ELECTRON CONTENT OF THE IONOSPHERE AND MAGNETOSPHERE c07
G. Schmidt *In its* Future Appl. of Satellite Beacon Expt. Nov. 1970 13 p (See N71-37883 24-13)
Avail: NTIS HC $3.00/MF $0.95

The satellite ATS-F, to be launched in 1972, will have a group delay radio beacon onboard. Two different radio signals are coherently amplitude-modulated and emitted. The proposed receiving equipment measures the time difference between the two signals by comparing the phase of the two modulation envelopes. The phase shift recorded is proportional to the total amount of total electron content, by the difference-differential-Doppler method. ESRO

N71-37915# Max-Planck-Institut fur Aeronomie, Lindau Uber Northeim (West Germany). Abteilung Weltraumphysik.
SOME RESULTS OF ATS-MEASUREMENTS
J. P. Schoedel, G. Schmidt, and G. K. Hartmann *In its* Future Appl. of Satellite Beacon Expt. Nov. 1970 12 p refs (See N71-37883 24-13)
Avail: NTIS HC $3.00/MF $0.95

ATS-3 signals were observed at low latitudes during May and June 1968, with a continuation during September 1968 to January 1969, and November 1969 to January 1970. The total ionospheric electron content is determined, and the influence of gravity waves on electron distribution is pointed out. Digital filters are used for data reduction. ESRO

N71-37916# Oulu Univ. (Finland). Dept. of Electrical Engineering.
OBSERVATIONS OF SATELLITE SCINTILLATIONS IN THE AURORAL ZONE
J. Oksman and A. Taurieinen *In* Max-Planck-Inst. fuer Aeronomie Future Appl. of Satellite Beacon Expt. Nov. 1970 9 p refs (See N71-37883 24-13)
Avail: NTIS HC $3.00/MF $0.95

Satellite signal scintillation in the auroral zone is frequent, appearing mostly by night. The scintillation is caused by irregularities in the ionospheric electron density, that modulate radio signals transmitted by the satellite. Results of beacon satellite S-66 Faraday and Doppler scintillation are given. ESRO

N71-37917# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany).
PRELIMINARY RESULTS OF DOPPLER MEASUREMENTS FOR NAVIGATION BY SATELLITES c21
A. Wallenhauer and O. Weber *In* Max-Planck-Inst. fuer Aeronomie Future Appl. of Satellite Beacon Expt. Nov. 1970 10 p refs (See N71-37883 24-13)
Avail: NTIS HC $3.00/MF $0.95

Doppler measurements were carried out on artifical earth satellites to determine the position of the Doppler equipment relative to the coordinate system of the US Naval Weapons Laboratory. The same data based on GEOS 2 satellite passes are analyzed separately in each case for one satellite pass to correlate major errors of position finding, with deviations of the ionosphere from a model used. ESRO

N71-37918# Fernmeldetechnisches Zentralamt, Darmstadt (West Germany).
RESULTS OF THE CCIR MEETING OF SEPTEMBER/OCTOBER 1969 WITH RESPECT TO THE APPLICATION OF SATELLITES FOR THE MARITIME AND AERONAUTICAL SERVICES c34
H. Werle *In* Max-Planck-Inst. fuer Aeronomie Future Appl. of Satellite Beacon Expt. Nov. 1970 5 p (See N71-37883 24-13)
Avail: NTIS HC $3.00/MF $0.95

Problems arising from the introduction of satellite systems for the aeronautical and marine services are examined. Satellite orbits, multipath effects, wave propagation and noise, communications satellite systems for aeroplanes and ships, satellite systems for radio determination, and combined satellite systems for telecommunication and radiodetermination are also considered. ESRO

N71-37919# Polish Academy of Sciences, Warsaw. Inst. of Geophysics.
DISCUSSION NOTE ON SMALL FREQUENCY FLUCTUATIONS OF SATELLITE RADIO SIGNALS c07
A. W. Wernik *In* Max-Planck-Inst. fuer Aeronomie Future Appl. of Satellite Beacon Expt. Nov. 1970 9 p refs (See N71-37883 24-13)
Avail: NTIS HC $3.00/MF $0.95

Differential or dispersive Doppler frequency measurements often exhibit small and fast irregular fluctuations, which appear even during quiet ionospheric conditions, when the amplitude scintillation is moderate. The fluctuations are not greater than 1 Hz and of a duration shorter than 0.5 sec. A method is presented to analyze the fluctuations, using several Explorer 22 night passes during February 1968. ESRO

N71-37920# Max-Planck-Institut fur Aeronomie, Lindau Uber Northeim (West Germany).
DISCUSSION NOTE ON PROBLEMS OF SEA

NAVIGATION c21
Gerhard Zickwolff (DHI, Hamburg) *In its* Future Appl. of Satellite Beacon Expt. Nov. 1970 5 p refs (See N71-37883 24-13)
Avail: NTIS HC $3.00/MF $0.95

The conventional methods of sea navigation are described, and the Transit and Omega navigation systems are mentioned. In view of collision avoidance, traffic control, and the growth of the world's oceanborne trade, it is concluded that satellite systems for navigation and traffic control of ships and aircraft are now feasible. ESRO

N71-37921# Naval Research Lab., Washington, D.C.
SOME BRIGHTNESS VARIATIONS IN THE NORTH SKY AND THE HORIZON SKY AND SEA MEASURED DURING DAYLIGHT HOURS Final Report
Elsie F. Dupre and Gordon L. Stamm 1 Jul. 1971 16 p refs
(AD-727118; NRL-7263) Avail: NTIS CSCL 04/1

Curves are presented to show measured diurnal variations in the luminance of the north sky at an arbitrary fixed point and also diurnal luminances, including their horizontal and vertical polarization components, of the sky and sea at the horizon. In both sets of measurements sky luminance data were obtained continuously with photoelectric photometers and recording equipment. Sky and sea luminances and their polarized components were measured manually at 15-min intervals. Large, rapid variations in the luminance of the north sky were observed because of cloud activity. At the horizon this was not observed for the sky. The effects of the sun's glitter pattern on the sea are shown; the ratio of polarization components and ratios of sky to sea values are given. The data indicate a need in visibility studies for measuring polarization characteristics and for continuously monitoring the background whether it be a point in the sky or the sky-sea horizon. Author (GRA)

N71-37922# Nova Univ., Dania, Fla. Physical Oceanographic Lab.
DEVELOPMENT OF AN OPERATIONAL SYSTEM FOR MEASURING OCEAN SURFACE CURRENT FROM AIRCRAFT Final Report
William S. Richardson May 1971 17 p
(Contract DOT-CG-10737-A)
(AD-726568) Avail: NTIS CSCL 08/3

The report contains the development of an operational system which permits surface current measurements (and, incidentally, volume transport measurements per unit width) to be made in the ocean from aircraft. It is assumed that this method will have applications to the Coast Guard's efforts in search and rescue and in pollution monitoring. An inexpensive, expendable probe is launched from the airplane and, on contacting the sea surface, a dye package separates and floats on the surface. The remainder of the probe is carried to the bottom by its weight and from its fixed location on the bottom releases two floats at separate, predetermined times. The floats return to the surface under their own buoyancy. At the surface the three parts (surface marker and two floats) emit florescent dye which can be photographed or otherwise relatively positioned. Author (GRA)

N71-37923# Finnish Meteorological Inst., Helsinki.
MAGNETIC RESULTS FROM NURMIJARVI GEOPHYSICAL OBSERVATORY, 1970, NO. 12
1971 32 p
Avail: NTIS

Measurements of earth magnetic field made at an observatory 40 kilometers northwest of Helsinki, Finland are presented. The instrumentation and conditions under which measurements were made are discussed. Tables of data obtained from magnetic measurements are included. Author

N71-37924# Florida Atlantic Univ., Boca Raton. Remote Sensing and Interpretation Lab.
TIDEWATER SHORELINES IN BROWARD AND PALM BEACH COUNTIES, FLORIDA: AN ANALYSIS OF CHARACTERISTICS AND CHANGES INTERPRETED FROM COLOR, COLOR INFRARED AND THERMAL AERIAL IMAGERY
L. Alan Eyre Jun. 1971 30 p ref
(Contracts N00014-67-A-0320-0003; Nonr-4761(00))
(AD-727630; TR-11) Avail: NTIS CSCL 14/5

In South Florida, pressures to extend and modify tidewater shorelines are very strong. These modifications include canal excavations, dredging and filling, bulkheading, erection of sea walls, and dock construction. Access to tidewater is much coveted and competition for such access is keen. Using color infrared aerial photography flown at 5000 ft., eight types of tidal shorelines are distinguished in a portion of NASA Test Site 164. Comparisons are made with other imagery, including high-altitude (60,000 ft.) photography and that from the Reconofax and Bendix Thermal Infrared sensor systems; and the degree to which these shoreline types are observable is noted. Some changes over time are also indicated, in particular the extent of additional modifications during a period of approximately one year. Author (GRA)

N71-37925# Bergen Univ. (Norway). Seismological Observatory.
DETECTION SEISMOLOGY, A SUMMARY
Markvard A. Sellevol 30 Jun. 1971 9 p
(Contract F61052-68-C-0019; ARPA Order 292-79)
(AD-727408; AFOSR-71-2077TR) Avail: NTIS CSCL 17/10

The report gives a review of the work conducted and the scientific reports submitted under the contract. The research group at the Seismological Observatory, University of Bergen, concentrated on: Noise and signal coherence study, the study of the crustal effect on the subarray signal, and the study of long period data. Within this wide frame, this group looked into problems relevant to detection seismology and related topics and made extended use of digital data from the NORSAR array. While for the first two fields the data actually recorded by the NORSAR installation was used, the NORSAR long period data was not available before the expiring data of this contract. Consequently the long period data base has consisted partly of seismograms from the Norwegian Standard Stations and partly of LASA data. Author (GRA)

N71-37926# Naval Scientific and Technical Information Centre, Orpington (England).
RELATIVE WATER TRANSPARENCY OF THE INDIAN OCEAN
V. I. Voitov et al Mar. 1971 8 p refs Transl. into ENGLISH from Okeanologiya (Moscow), v. 10, no. 1, 1970 p 48-50
(AD-727857; NSTIC-Trans-2344) Avail: NTIS CSCL 08/10

From observations of the depth of visibility of the white disc made chiefly in recent years, a map of the relative water transparency has been made for the northern part of the Indian Ocean and Antarctic waters. The relationship between the relative transparency and the plankton concentration is analyzed and also the connection between the relative transparency distribution and the circulation of surface waters. Author (GRA)

N71-37927# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE SCIENTIFIC RESULTS OF THE FLIGHTS OF THE AUTOMATIC IONOSPHERIC LABORATORY "YANTAR", PART 3
G. L. Grodzovskii et al 1 Mar. 1971 29 p refs Transl. into ENGLISH from Dokl. na 21 Kongresse MAF (West Germany), 1970 p 1-26
(AD-727882; FTD-MT-24-360-70) Avail: NTIS CSCL 04/1

With the help of geophysical rockets at altitudes of 100-400 km the automatic ionospheric laboratories 'Yantar' with gas plasma-ion engines were launched to investigate the possibilities of controlling flight in the upper layers of the atmosphere. The performance of the gas plasma-ion engines operating on argon, nitrogen, and air was investigated under conditions of flight in the atmosphere. The parameters

characterizing the interaction of the ion jet with ionospheric plasma and the parameters of the neutral atmosphere were measured. The report contains the scientific results of the in-flight experiments conducted. Author (GRA)

N71-37928*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
SOME CONSIDERATIONS IN THE SELECTION OF AIRCRAFT FOR EARTH RESOURCE OBSERVATIONS
Roger D. Arno and Jerry M. Deerwester Washington Oct. 1971 18 p refs
(NASA-TM-X-2418; A-4046) Avail: NTIS CSCL 08G

The logistics problems and cost aspects of earth resource surveys using various types of aircraft are discussed. Eight categories of aircraft (from piston engine to large jet) as well as commercial air carriers are examined on the basis of quantity needed, coverage afforded, and annual program cost. Independent parameters in the analysis include (1) the requirements of a typical group of resource features, (2) number and location of bases, (3) cloud cover uncertainty, and (4) aircraft cost and the parametric influence of payload associated costs. The results obtained in this analysis show an advantage in cost and rate of coverage for a special fleet of twin engine turbojets over all other aircraft options. Special fleets of turboprop, large turbojet, piston engine planes and commercial air carriers were found to be inferior, principally because of the greater number of aircraft required to achieve comparable coverage. To illustrate, to cover 45 to 95 percent of the resources considered about every two weeks, the special fleet of twin-engine jets requires 6 to 30 aircraft, while the commercial air carrier numbers range from 36 to 180 for coverage ranging from 40 to 80 percent. Annual program operating costs would appear to run between $2 and $10 million plus the costs associated with payload and data handling. Total costs might average between $10 and $100 million annually. Author

N71-37929# Stanford Univ., Calif. Dept. of Civil Engineering.
A REFINED MEASUREMENT OF AERODYNAMIC PRESSURES OVER PROGRESSIVE WATER WAVES
Hai Yen Yu and En Yub Hsu Jun. 1971 80 p refs
(Contract N00014-67-A-0112-0059; Grant NSF GK-25)
(AD-728008; TR-146) Avail: NTIS CSCL 04/1

Improved pressure sensing and wave following systems for the investigation of the characteristics of the turbulent air stream in the vicinity of air-water interface were developed. A reappraisal of Miles' inviscid theory was made. A carefully controlled experiment designed to match assumptions was performed by using the newly developed systems. The wave-induced pressure signal was extracted by using a waveform educator. The result, in terms of both pressure magnitude and phase angle, was summarized with the experimental results of others to compare with Miles' inviscid theory. Author (GRA)

N71-37930# Weapons Research Establishment, Adelaide (Australia).
RESULTS OF AN OPTICAL OZONESONDE TEST FLIGHT CONDUCTED FROM (MILDURA,) AUSTRALIA, 21 DECEMBER 1968
N. V. Siesons Mar. 1970 29 p refs
(WRE-TN-HSA-168) Avail: NTIS

An experimental ultraviolet photometer developed to provide a basis for an optical sensor for the dropsonde system is described. The results of a test flight to an altitude of 36.6 km are compared with those obtained from commercial electrochemical ozone sondes flown on the same day at other stations. Author

N71-37931# Weapons Research Establishment, Salisbury (Australia).
ON THE ANALYSIS OF DATA FROM OPTICAL OZONE SONDES
N. V. Siesons Mar. 1970 49 p refs
(WRE-TN-HSA-153) Avail: NTIS

Four synthetic ozone density profiles were used to predict the behavior of the proposed dropsonde system in the altitude range 75 to 20 km. It was found that the standard assumptions made in determining the ozone profile from rocket-borne absorption experiments are inadequate for ozone slant amounts in excess of 3 x 10 to the minus 3rd power atm cm. A semiempirical correction was developed which gives a closer approximation to the true ozone profile in such cases. The effects of temperature and different solar spectral distributions upon the derived quantities were also analyzed. Author

N71-37932# National Oceanic and Atmospheric Administration, Boulder, Colo.
RADIATIVE TRANSFER OBSERVATIONS AND CALCULATIONS DURING BOMEX
P. M. Kunk and L. P. Steams Apr. 1971 173 p refs
(NOAA-TR-ERL-203-APCL-19) Avail: SOD $1.50

A comparison is made of the balloon borne radiometersonde ascents made during BOMEX and laboratory calculations. The calculations were made using the radiative transfer equation. Radiative cooling was also discussed. Author

N71-37933# Geological Survey, Washington, D.C.
THE SAN FERNANDO, CALIFORNIA, EARTHQUAKE OF 9 FEBRUARY 1971
1971 261 p refs Prepared jointly with NOAA
(PP-733) Avail: SOD $2.25

Photographs and descriptions are presented of the damage which resulted from the San Fernando earthquake. Also presented are discussions and descriptions of the geology, seismology, and earthquake history of the area. A.L.

N71-37934# National Oceanic and Atmospheric Administration, Boulder, Colo. Environmental Research Labs.
OPTIMIZATION OF FREQUENCIES USED IN INDIRECT SENSING BY INVERSION
Otto Neall Strand Mar. 1971 25 p refs
(NOAA-TR-ERL-202-WPL-14) Avail: SOD $0.35

An expression for the expected mean square error in the statistical estimation of tropospheric temperature profiles by the inversion of microwave thermal emission measurements was derived. A semi-probabilistic computer search technique was devised to determine the frequencies that minimize this expected mean square error for a given (small) number of microwave frequencies. Although a specific problem is solved here, the methods are general, and can be applied to any situation involving optimum linear estimation of the solution of a Fredholm integral equation of the first kind with specified a priori mean and covariance data on the unknown function. Author

N71-37935# National Oceanic and Atmospheric Administration, Boulder, Colo.
FARADAY ROTATION EXPERIMENTS IN THE D REGION
G. W. Adams Apr. 1971 31 p refs
(NOAA-TR-ERL-205-SEL-21) Avail: SOD $0.40

The use of the Faraday rotation technique for determining electron densities in the D region is examined theoretically and experimentally. Theoretically it is found that, as one goes lower in altitude, the accuracy of the technique decreases, while the data analysis becomes increasingly susceptible to catastrophic errors caused by small errors in the altitude determination, the collision frequency profile, etc. Experimentally it is found that neither Appleton-Hartree nor Sen-Wyller theory, when used to reduce Faraday rotation data, gives correct results at low altitudes. This is based on comparisons to true electron density profiles determined from measurements of solar proton energy spectra and the effective electron loss rates in the D region. Author

N71-37936# Environmental Protection Agency, Research Triangle Park, N.C.
MOUNT STORM, WEST VIRGINIA - GORMAN, MARYLAND, AND LUKE, MARYLAND - KEYSER, WEST VIRGINIA, AIR POLLUTION ABATEMENT ACTIVITY
Apr. 1971 156 p refs
(APTD-0656) Avail: NTIS

The increase in poor quality commercial Christmas trees in recent years is discussed for the mountainous area of Maryland and West Virginia bordering the North Branch of the Potomac River. Tree injuries are examined and evaluated; they include discoloration, browning of needles, lack of foliage, and disfiguration. Air quality was measured for SO2, nitrogen oxides, oxidants, flourides, and other particulate matter contaminants. It was determined that these injuries were caused by air pollution, specifically SO2 from a large VEPCO power plant in close proximity. J.A.M.

N71-37937# Joint Publications Research Service, Washington, D.C.
GEOPHYSICAL INFORMATION ON MANGYSHLAK PENINSULA FROM SPACE PHOTOGRAPHS
M. A. Artamonov et al 7 Oct. 1971 7 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (USSR), v. 199, no. 1, 1971 p 69-72
(JPRS-54204) Avail: NTIS

The geophysical information content of orbital photos was established in order to clarify the degree to which deep-seated structural elements are portrayed by geophysical data. The possibility of using the photos for raising the quality of geophysical anomaly interpretation is considered. For this purpose, the geologic and geophysical interpretations of photos for the Mangyshlak Peninsula in Kazakhstan was carried out based on data received from the Soviet spacecraft Soyuz 8. Author

N71-37938 National Lending Library for Science and Technology, Boston Spa (England).
STATISTICAL STRUCTURE OF WATER TEMPERATURE FIELDS IN THE NORTH ATLANTIC
D. I. Vacnadze et al 1970 13 p refs Transl. into ENGLISH from Gidromet. Nauch. Issled. Cent. SSSR (Leningrad), v. 63, 1970 p 32-42
(NLL-M-20364-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

Air temperature distributions over seas and oceans are considered in an analysis of variance using eigenfunctions. Stationary weather ship data for 1949 - 1966 on the monthly mean temperature anomalies of the surface water layer were used. The information value of various coefficients of the eigenfunction expansion was obtained. K.P.D.

N71-37939 Stanford Univ., Calif.
NONDUCTED VLF PROPAGATION IN THE MAGNETOSPHERE
Fernando Walter (Ph.D. Thesis) 1970 155 p
Avail: Univ. Microfilms Order No. 70-18500

The nonducted signals described are received in the ionosphere between 47 deg and 56 deg invariant latitude. They have never been observed on the ground and include natural whistlers and fixed-frequency signals (10.2 - 12.5 kHz) from the U. S. Navy Omega transmitters. In a frequency-time spectrogram, these nonducted whistlers appear as rising tones with a lower cutoff frequency in the approximate range of 5 to 8 kHz. Observed spectral shapes of such whistlers resemble a fish hook. Fixed-frequency Omega signals observed by OGO 4 in the hemisphere conjugate to the transmitter frequently have characteristics similar to those of the walking trace whistlers. The Omega signals exhibit two features that are not apparent in the natural whistlers: an enhancement of signal strength and a Doppler shift that increases with latitude and may reach hundreds of Hertz. The main characteristics of the above phenomena are explained by tracing nonducted rays between conjugate hemispheres in a model magnetosphere. An equatorial electron density profile is derived from the walking trace whistlers. Dissert. Abstr.

N71-37940 Kakioka Magnetic Observatory (Japan).
REPORT OF THE KAKIOKA MAGNETIC OBSERVATORY: GEOMAGNETISM, KANOYA, 1969
1971 65 p refs *Its* Ser. Rept. No. 80
(Rept-80) Avail: Issuing Activity

Magnetic observations for 1969 from Kanoya, Japan are presented in tabular form. Hourly values of declination, horizontal intensity, and vertical intensity as well as mean hourly values for each element, and North and West components for all, calm, and disturbed days are included. Three-hour-range indices and character figures are given as well as the general characteristics of principle magnetic disturbances. Reproductions of magnetograms for principle magnetic disturbances in 1969 are also included. J.M.

N71-37941 Kakioka Magnetic Observatory (Japan).
REPORT OF THE KAKIOKA MAGNETIC OBSERVATORY: GEOMAGNETISM, MEMAMBETSU, 1969
1971 65 p refs *Its* Ser. Rept. No. 79
(Rept-79) Avail: Issuing Activity

Magnetic observations for 1969 from Memambetsu, Japan are presented in tabular form. Hourly values of declination, horizontal intensity, and vertical intensity as well as mean hourly values for each element, and North and West components for all, calm, and disturbed days are included. Three-hour-range indices and character figures are given as well as the general characteristics of principle magnetic disturbances. Reproductions of magnetograms for the principle magnetic disturbances in 1969 are also included. J.M.

N71-37942 Kakioka Magnetic Observatory (Japan).
REPORT OF THE KAKIOKA MAGNETIC OBSERVATORY: GEOMAGNETISM, KAKIOKA, 1969
1971 119 p refs *Its* Ser. Rept. No. 78
(Rept-78) Avail: Issuing Activity

Magnetic observations for 1969 from Kakioka, Japan are presented in tabular form. Hourly values of declination, horizontal intensity, and vertical intensity as well as mean hourly values for each element, and North and West components for all, calm, and disturbed days are included. Three-hour-range indices and character figures are given as well as the general characteristics of principle magnetic disturbances. Reproductions of magnetograms for the principle magnetic disturbances in 1969 are also included. J.M.

N71-37943 Washington Univ., Seattle.
A DIAGNOSTIC STUDY OF LARGE SCALE WAVE DISTURBANCES IN THE LOWER EQUATORIAL STRATOSPHERE
Vernon Edgar Kousky (Ph.D. Thesis) 1969 114 p
Avail: Univ. Microfilms Order No. 70-19633

The three-dimensional characteristics of Kelvin waves are studied using radiosonde data which is analyzed by hand and spectrum analysis techniques. Kelvin waves are found to occur primarily in regions of easterlies where the mean zonal wind is becoming more westerly with time. The waves are observed to be symmetric about the equator with maximum amplitude at the equator and to propagate eastward with phase speeds of 15-30 m/sec. Westerly momentum is transported upward by the waves and absorbed in regions of strong westerly shear. The calculated accelerations of the mean flow due to this absorption of momentum are comparable to the observed accelerations. The regions of westerly shear are greatly enhanced with the passage of easterly phases of Kelvin waves. The increased vertical shear is sufficient to reduce the Richardson number to 0.25, the critical value for the onset of turbulence. Turbulence probably exists in the westerly shear zones and that this is the mechanism for absorbing Kelvin waves. Dissert. Abstr.

N71-37944 New York Univ., N.Y.
SCATTERING OF LOVE WAVES IN A SURFACE LAYER WITH AN IRREGULAR BOUNDARY FOR THE CASE OF A RIGID UNDERLYING HALF-SPACE
Lawrence M. Slavin (Ph.D Thesis) 1969 127 p
Avail: Univ. Microfilms Order No. 70-19285

A method is presented which is useful for obtaining the scattered field due to a Love wave incident upon a local boundary irregularity in the elastic layer along which it is propagating. The problem is solved for the special case of a rigid halfspace underlying the layer. The method uses a least squares procedure to approximately satisfy the traction-free boundary condition at the free surface irregularity and is shown to give good results for cases in which other approximate methods are not accurate. Data from specific examples are given which shows the general range of applicability of the present approach. Dissert. Abstr.

N71-38580# Academy of Sciences (USSR), Moscow.
GEOPHYSICAL EFFECTS PRODUCED BY THE TUNGUSKA EXPLOSION OF 1908
A. V. Zolotov *In its* Proc. of the 6th Ann. All-Union Winter School on Space Phys., Part 2 1969 p 26-27 In RUSSIAN (See N71-38582 24-30)
Avail: NTIS

N71-38604# Academy of Sciences (USSR), Moscow.
COMPARATIVE ANALYSIS OF VARIOUS MODELS OF THE GEOMAGNETIC FIELD
V. A. Eltskov and V. F. Nikitin *In its* Proc. of the 6th Ann. All-Union Winter School on Space Phys., part 2 1969 p 81 In RUSSIAN (See N71-38582 24-30)
Avail: NTIS

N71-38613# Academy of Sciences (USSR), Moscow.
EQUIPMENT FOR MEASURING THE RETARDATION OF X-RADIATION IN THE STRATOSPHERE IN THE ZONE OF THE POLAR GLOW
I. A. Kuzmin *In its* Proc. of the 6th Ann. All-Union Winter School on Space Phys., part 2 1969 p 126-127 refs In RUSSIAN (See N71-38582 24-30)
Avail: NTIS

14 INSTRUMENTATION AND PHOTOGRAPHY

Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gages; recorders; transducers; aerial photography; and telescopes and cameras.

N71-37945*# Allied Research Associates, Inc., Concord, Mass.
USE OF GROUND-TRUTH MEASUREMENTS TO MONITOR ERTS SENSOR CALIBRATION, VOLUME 2
Romeo R. Sabatini and George Rabchevsky Oct. 1970 106 p refs 3 Vol.
(Contract NAS5-10343)
(NASA-CR-121979; ARA-9G45-70-Vol-2; TR-16-Vol-2) Avail: NTIS CSCL 14B

The calibration of Earth Resources Technology Satellites (ERTS) sensors is described. Two alternative procedures for monitoring ERTS sensor calibrations at the ERTS Data Center are presented. The concept of ground-truth sites is central to the calibration procedures and ground-truth site requirements are discussed and site selections are specified. Prelaunch and postlaunch data requirements over these sites are described. Author

N71-37946*# Allied Research Associates, Inc., Concord, Mass. Geophysics and Aerospace Div.
ERTS: A PHOTOGRAPHIC DATA MANAGEMENT CONCEPT, VOLUME 3
Walter C. Ahlin, Earl S. Merritt, and John E. Slesala Jan. 1971 166 p refs 3 Vol.
(Contract NAS5-10343)
(NASA-CR-121980; TR-16-Vol-3; ARA-9G45-70-77-Vol-3) Avail: NTIS CSCL 14B

Earth Resources Technology Satellite (ERTS) data rates and time lines are combined with user requirements to derive a development plan for implementation and operation of a supporting photographic data processing, management, and dissemination system. The plan specifies requirements for and phasing of facilities, equipment, personnel and operating procedures. Author

N71-37947*# California Univ., Berkeley. Forestry Remote Sensing Lab.
THE USE OF MULTISPECTRAL SENSING TECHNIQUES TO DETECT PONDEROSA PINE TREES UNDER STRESS FROM INSECT OR PATHOGENIC ORGANISMS Annual Progress Report
R. C. Heller, R. C. Aldrich, W. F. Mc Cambridge, F. P. Weber, and S. L. Wert 30 Sep. 1968 51 p refs Prepared in cooperation with Pacific Southwest Forest and Range Expt. Sta.
(NASA Order W-12996)
(NASA-CR-122647) Avail: NTIS CSCL 14B

Airborne sensors to detect and map the presence of dying conifers before visual symptoms occur, and, the smallest scale of aerial photography that may be used to detect insect epidemics from space altitudes are discussed. A pilot test was conducted on a three-square-mile area to simulate conditions expected from space photography. Color and infrared color transparencies were produced at the following scales: 1:116,000, 1:63,360, 1:31,680, 1:15,840, and 1:7,920. Photo interpretation of large-scale transparencies (1:1,584) showed best results when foliage was most discolored in August. Author

N71-37948# Central Research Inst. for Physics, Budapest (Hungary).
CONTINUOUS MEASUREMENT OF THE ACTIVITY CONCENTRATION OF RADIOIODINE IN AIR
L. Molnar Mar. 1971 16 p refs
(KFKI-71-13) Avail: AEC Depository Libraries

An automatic instrument for the continuous measurement of the activity concentration of radioiodine in the air is described. The air is sampled by a band of Wattmann's ACG/B filter material driven at a constant but variable speed. A NaI(tl) crystal is used as detector. By calibration with an I-131 standard, the instrument was found to have a measuring range of 10 to the minus 10th power to 0.000001 Ci/cum and high sensitivity. The results of investigations with the device on the ventilation system of an experimental reactor are reported. Author (NSA)

N71-37949# Toulouse Univ. (France). Faculte des Sciences.
DEVELOPMENT AND STUDY OF MULTIPLE ANODE HALOGEN GEIGER-MUELLER COUNTERS [REALISATION ET ETUDE DE COMPTEURS GM A HALOGENES A ANODES MULTIPLES]
Ali Sekhavat (Ph.D. Thesis) 1970 78 p refs In FRENCH; ENGLISH summary
(NP-18898) Avail: AEC Depository Libraries

A substantial improvement of the halogen Geiger-Muller counter properties was carried out by studying new anode forms. This amelioration was revealed by the comparison of the new counters with the classical ones, absolutely identical in size and production, only the anodes being different. NSA

N71-37950# Comitato Nazionale per l'Energia Nucleare, Frascati (Italy).
PRECISION OF AN OPTICAL SPARK CHAMBER WITH

WIRE ELECTRODES [PRECISIONE DI CAMERE A SCINTILLA OTTICHE CON ELETTRODI A FILI]
D. Bisello and F. Ronga 5 Oct. 1970 9 p refs In ITALIAN /ts Note No. 491
(LNF-70/44) Avail: AEC Depository Libraries

The precision obtainable in the determination of particle trajectories with an optical spark chamber with wire electrodes is studied. A better precision is obtainable with a chamber with a large gap, but a higher efficiency is obtained with a narrow gap chamber. In order to obtain a good compromise between angular efficiency and precision, the internal chamber of the Adone Magnet experiment was designed with alternating large and narrow bigaps. The analysis system adopted is described and discussed. NSA

N71-37951# Comitato Nazionale per l'Energia Nucleare, Frascati (Italy).
HEAVY GAS-LIQUID MIXTURE BUBBLE CHAMBER OF 70 LITERS VOLUME WITH HYDROGEN INTERNAL TARGET [UNA CAMERA A BOLLE A MISCELA PESANTE GAS-LIQUIDO DI 70 LITRI DI VOLUME CON BERSAGLIO INTERNO DI IDROGENO]
P. E. Argan, P. Benvenuto, D. Fabbri, L. Fiore, G. Gialanella et al 16 Jun. 1970 12 p refs In ITALIAN /ts Note No. 480
(LNF-70/25) Avail: AEC Depository Libraries

A bubble chamber with a heavy gas-liquid mixture used with the gamma beam of an electrosynchrotron is described. The bubble chamber was adapted for insertion in an analyzer magnet and provided with an internal gaseous hydrogen target at high pressure. The mechanical characteristics of the bubble chamber, the expansion and recompression apparatus, the analyzer magnet, the response optics, the command and control electronics, and operational characteristics of the chamber and the internal hydrogen target are described. NSA

N71-37952*# Ohio State Univ. Research Foundation, Columbus. Dept. of Geodetic Science.
AN INVESTIGATION INTO SOME PROBLEMS OF LUNAR ORBITER PHOTOGRAPHY SYSTEM Interim Report
Peter James Morgan Aug. 1971 140 p refs
(Grant NGR-36-008-125)
(NASA-CR-123174; Rept-162) Avail: NTIS CSCL 14E

The Lunar Orbiter photographic subsystem is used as an example of a nonmetric system. A mathematical model is presented which takes into consideration image motion and camera movement during exposure. Problems encountered in the solution of large systems of equations are discussed. The proposed mathematical model was tested numerically using simulated lunar data with known true parameter values. Author

N71-37953*# Tennessee Technological Univ., Cookeville. Dept. of Engineering Science.
INVESTIGATION OF STRESS WAVES AND EFFECTS OF HYPERVELOCITY IMPACT Final Report
Ray Kinslow 30 Nov. 1970 16 p refs
(Grant NGR-43-003-007)
(NASA-CR-123157) Avail: NTIS CSCL 14B

An annotated bibliography of 12 items on stress waves and effects of hypervelocity impacts is presented. A paper presented at the International Conference of Electron-Optics which describes a polariscope for analysis of stress waves in birefringent materials is also submitted. Abstracts investigations include: stress waves in multiple laminates and sandwich plates, photoelastic investigation of stress wave loading of a crack, properties of reflected stress waves, meteoroid hazard to space travel, and high speed impact phenomena. E.M.C.

N71-37954*# Colorado Engineering Experiment Station, Inc., Boulder.
TWO PRIMARY METHODS OF PROVING GAS FLOW METERS Final Report
B. T. Arnberg and C. L. Britton 31 Aug. 1971 15 p refs
(Contract NSR-06-043-001)
(NASA-CR-72896) Avail: NTIS CSCL 14B

Two primary methods are presented for determining the mass flow rates of gases for use in calibrating gas flowmeters up to 9 kg/sec (20 lb/sec). The rate of flow is determined from the time interval for a measured change of mass in a storage vessel. In one of the two methods the change of mass is determined by weighing the storage vessel on an analytical balance before and after the test (the mass-time method). In the other method the mass is determined from the calibrated volume of the storage vessel, and the pressure and temperature measurements made before and after the test. This is called the pressure-volume-temperature-time (PVTt) method. The estimated uncertainty in a mass flow rate measurement on the mass-time facility is + or - 0.02 percent; and + or - 0.06 percent on the PVTt facility. Author

N71-37955*# National Aeronautics and Space Administration, Washington, D.C.
SCIENTIFIC SPACE STATION "PROTON-4" [NAUCHNAYA KOSMICHESKAYA STANTSIYA "PROTON 4"]
G. I. Astakhov et al Oct. 1971 86 p refs Transl. into ENGLISH from Acad. of Sci., USSR Report PR-10, 1970 98 p
(NASA-TT-F-13731; PR-10) Avail: NTIS CSCL 03B

High and superhigh energy cosmic rays were analyzed for energies up to approximately 10 to the 15th power eV. The charge spectrum of high energy particles was recorded, and the effective cross section of elastic collisions between cosmic ray particles and light and heavy atomic nuclei were analyzed as a function of energy. Hypothetical fundamental particles with fractional electrical charges (quarks) were sought in cosmic rays. High energy electrons were observed in near-earth space. The spectrometers, detectors, and other equipment used for measurement of the energy and charge spectra and for analyzing nuclear interaction characteristics are described and illustrated. Author

N71-37956*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DESIGN OF A RADIOACTIVE NON-CONTACT ENCODER
M. B. Barnett Aug. 1971 20 p refs
(NASA-TM-X-66715; X-721-71-349) Avail: NTIS CSCL 14B

A non-contact encoder device of the detection of radioactive sources is described. The device consists of: (1) encoder assembly; (2) radioactive source of Am-241 and (3) a semiconductor silicon diode detector. The theory of operations, performance, advantages, disadvantages, and applications are discussed. A.L.

N71-37957*# Louisiana State Univ., Baton Rouge. Div. of Engineering Research.
THE DESIGN AND CONSTRUCTION OF A HOHLRAUM SPECTRAL ANALYZER Progress Report, Sep. 1970 - Sep. 1971
Dupree Maples and C. A. Whitehurst Sep. 1971 13 p
(Grant NGR-19-001-024)
(NASA-CR-123170) Avail: NTIS CSCL 14B

A program is reported aimed at the development of a spectral analyzer to facilitate research regarding air pollutants. In particular, the analyzer is designed to provide instrumentation for the determination of the effects that additives and impurities in gasoline have on exhaust emission. A general description of the instrument is given along with a functional description of each component. A step by step procedure to illustrate the method for operating the analyzer is included. D.L.G.

N71-37958*# Atlantic Research Corp., Costa Mesa, Calif. System Div.
THE DEVELOPMENT OF AN AIRBORNE SYSTEM FOR THE SAMPLING OF ATMOSPHERIC ORGANICS Final Report
R. L. Chuan 1 Jun. 1971 37 p ref
(Contract NAS2-5421)

(NASA-CR-114378) Avail: NTIS CSCL 06A

The development program is the second phase of three-phase program to help evaluate the concept that airborne atmospheric probes can be useful tools for observing and classifying planetary biological activity. The program seeks to examine the uniqueness of pairing the flora of a biologically homogeneous region with the set of concentrations of organic chemicals found in the surrounding atmosphere when other parameters are fixed. If such relationships exist, they could yield significant information in the search for flora on other planets by looking for similarities to terrestrial forms. The flight sampling system is described, together with its operation and calibration procedures and results from flight and laboratory measurements. Recommendations are given for minor modifications to the system and the calibration procedure which should correct the inadequacies noted in flight and laboratory tests. Author

N71-37958*# American Science and Engineering, Inc., Cambridge, Mass.

ALPHA AND X-RAY SPECTROMETERS: APOLLO LUNAR ORBITAL SCIENCE PROGRAM Final Report

23 Sep. 1971 11 p

(Contracts NAS9-9982; NAS9-9983)

(NASA-CR-115216; ASE-2818) Avail: NTIS CSCL 03B

A descriptive summary is presented of the design, development, fabrication, test, checkout, and support activities for delivery of integrated X-ray and alpha-particle spectrometer systems for the NASA Apollo Lunar Orbital Science program. Author

N71-37960# European Southern Observatory, Hamburg (West Germany).

LARGE TELESCOPE DESIGN

Richard M. West, ed. Jun. 1971 512 p refs Partly in ENGLISH and partly in FRENCH Proc. of Conf. held at Geneva, 1-5 Mar. 1971 Prepared jointly with CERN

Avail: NTIS HC $6.00/MF $0.95

Proceedings of a large telescope design conference are reported, including the current progress of several telescope projects and experiments. Optical aspects, mountings, and control and drive systems for telescopes are also reviewed. For individual titles, see N71-37961 through N71-37999.

N71-37961# European Southern Observatory, Hamburg (West Germany). AAT Project Office.

PRESENT STATUS OF THE ANGLO-AUSTRALIAN TELESCOPE

H. Wehner *In its* Large Telescope Design Jun. 1971 p 9-12 (See N71-37960 24-14)

Avail: NTIS HC $6.00/MF $0.95

Progress is reported on the Anglo-Australian project to build a 150-inch optical telescope for observations of the southern sky. Among the sections treated are the mounting and drive and control, the optical system, the instrumentation, computerized control, and the building to house the telescope. It is anticipated that the telescope will become operational in 1974. ESRO

N71-37962# Kitt Peak National Observatory, Tucson, Ariz.

AURA'S TWO 150-INCH TELESCOPES Status Report

D. L. Crawford *In* European Southern Obs. Large Telescope Design Jun. 1971 p 23-36 Presented at Opt. Soc. of Am. Meeting, Tucson, Ariz., 5-8 Apr. 1971 Sponsored by NSF (See N71-37960 24-14)

Avail: NTIS HC $6.00/MF $0.95

The progress is reported on the project to build a 150-inch telescope at the Kitt Peak National Observatory, Arizona, and Cerro Tololo, Chile. Among the topics covered are the financing of the project, the optical and mirror system, and instrumentation. ESRO

N71-37963# Carnegie Institution of Washington, D.C.

THE LAS CAMPANAS OBSERVATORY

H. W. Babcock *In* European Southern Obs. Large Telescope Design Jun. 1971 p 37-42 (See N71-37960 24-14)

Avail: NTIS HC $6.00/MF $0.95

The privately funded 100-inch telescope to be built and installed at Cerro Las Campanas, Chile is described. The site was chosen for the excellent viewing conditions, and possibilities of sites for other installations were also examined. ESRO

N71-37964# Dominion Astrophysical Observatory, Victoria (British Columbia).

THE CANADIAN 157-INCH TELESCOPE PROJECT

G. J. Odgers *In* European Southern Obs. Large Telescope Design Jun. 1971 p 43-55 (See N71-37960 24-14)

Avail: NTIS HC $6.00/MF $0.95

The present status of the 157-inch Ritchey-Chretien telescope in Canada is given, and the difficulties encountered when environment support was withdrawn are outlined. ESRO

N71-37965# Institut National d'Astronomie et de Geophysique, Meudon (France).

THE TELESCOPE PROJECT OF THE NATIONAL INSTITUTE OF ASTRONOMY AND GEOPHYSICS [PROJET DE TELESCOPE DE L'INAG]

R. Cayrel and P. Y. Bely *In* European Southern Obs. Large Telescope Design Jun. 1971 p 59-63 In FRENCH (See N71-37960 24-14)

Avail: NTIS HC $6.00/MF $0.95

The French telescope project is described. The origin and history of this project are given, as well as its general characteristics. ESRO

N71-37966# Osservatorio Astrofisico di Arcetri, Florence (Italy).

THE ITALIAN 3.5-m TELESCOPE PROJECT

G. Righini and J. C. Ferrell (Dilworth, Secord, Meagher and Assoc.) *In* European Southern Obs. Large Telescope Design Jun. 1971 p 65-73 (See N71-37960 24-14)

Avail: NTIS HC $6.00/MF $0.95

The optical parameters are outlined, and the mounting and tube are described. ESRO

N71-37967# Max-Planck-Institut fuer Astronomie, Heidelberg (West Germany).

THE PROJECT OF THE MAX-PLANCK-INSTITUT FUER ASTRONOMIE

H. Elsasser *In* European Southern Obs. Large Telescope Design Jun. 1971 p 75-84 refs (See N71-37960 24-14)

Avail: NTIS HC $6.00/MF $0.95

A description is given of the Federal German Republic astronomical project. The project consists of an institute at Heidelberg for the study of optical astronomy and analysis of observations, a Northern Hemisphere observatory in Spain, and a Southern Hemisphere observatory to be located either in Chile or Southwest Africa. The telescopes for the observations are described, and the choice of sites discussed. ESRO

N71-37968# Spetsialnaja Astrofizicheskaja Observatorija, St. Zhelenchukskaja (USSR).

THE SOVIET 6-m TELESCOPE PROJECT

I. M. Kopylov *In* European Southern Obs. Large Telescope Design Jun. 1971 p 85-98 (See N71-37960 24-14)

Avail: NTIS HC $6.00/MF $0.95

A description is given of the 6-m (236") telescope with alt-azimuth mounting located in the Caucasus chain. The mountings, optics, and mechanical features are considered, as well as the digital computerized control system. ESRO

N71-37969# European Southern Observatory, Hamburg (West Germany).

THE ESO 3.60-m TELESCOPE [LE TELESCOPE DE 3.60M

ESO]
C. Fehrenbach *In its* Large Telescope Design Jun. 1971 p 99-124 In FRENCH; ENGLISH summary (See N71-37960 24-14)
Avail: NTIS HC $6.00/MF $0.95

The site and telescope of the European Southern Observatory at Cerro La Silla, Chile is described. The 3.66-m telescope mirror is considered, along with the mounting and focusing. The building and auxiliary instruments are also described. ESRO

N71-37970# Zeiss (Carl), Oberkochen (West Germany).
OPTICAL DESIGN FOR LARGE TELESCOPES
R. N. Wilson *In* European Southern Obs. Large Telescope Design Jun. 1971 p 131-177 refs Sponsored by Bundesmin. fuer Bildung und Wiss. (See N71-37960 24-14)
Avail: NTIS HC $6.00/MF $0.95

Optical design of telescopes at Carl Zeiss, Oberkochen is given. Among the aspects considered are the primary and secondary foci, correctors, focal reducers, lens systems, and mirror solutions. ESRO

N71-37971# Dominion Astrophysical Observatory, Victoria (British Columbia).
COUDE OPTICAL DESIGN
E. H. Richardson *In* European Southern Obs. Large Telescope Design Jun. 1971 p 179-197 refs (See N71-37960 24-14)
Avail: NTIS HC $6.00/MF $0.95

The coude focus operates on-axis, simplifying optical design, and consists of an aspherical secondary mirror followed by a series of flat mirrors leading the light out of the telescope to the coude focus. The use of coude mirrors for various Canadian telescopes is examined. Optical coatings, of focal ratio, flexure, and performance are also discussed. ESRO

N71-37972# Observatoire de Marseille (France).
OPTICAL ALIGNMENT [ALIGNEMENT DE L'OPTIQUE]
A. Baranne *In* European Southern Obs. Large Telescope Design Jun. 1971 p 199-204 refs In FRENCH (See N71-37960 24-14)
Avail: NTIS HC $6.00/MF $0.95

The importance of off-center aberrations at the Cassegrain focus of the ESO telescope is considered, and methods for overcoming them proposed, based on spherical mirrors. ESRO

N71-37973# Kitt Peak National Observatory, Tucson, Ariz.
MIRROR SUPPORTS
E. T. Pearson *In* European Southern Obs. Large Telescope Design Jun. 1971 p 205-211 (See N71-37960 24-14)
Avail: NTIS HC $6.00/MF $0.95

Selected aspects of mirror supports for ground-based reflecting telescopes are discussed. Among the aspects considered are passive and active supports, mirror definition, lightweight mirrors, and optical shape. ESRO

N71-37974# Mount Stromlo Observatory, Canberra, (Australia).
A NOTE ON TESTING PRIME FOCUS CORRECTORS
S. C. B. Gascoigne *In* European Southern Obs. Large Telescope Design Jun. 1971 p 215-217 (See N71-37960 24-14)
Avail: NTIS HC $6.00/MF $0.95

A method is described for testing prime focus correctors for the Anglo-Australian telescope. The method requires an ellipsoid as auxiliary mirror which has the advantage of being able to be tested at conjugent foci. ESRO

N71-37975# Recherches et Etudes d'Optique et de Sciences Connexes, Ballainvilliers (France).
LARGE ASPHERICAL SURFACE CONTROL BY SPHEROMETRY [CONTROLE PAR SPHEROMETRIE DES GRANDES SURFACES ASPHERIQUES]
J. Eaglard *In* European Southern Obs. Large Telescope Design Jun. 1971 p 219-228 In FRENCH (See N71-37960 24-14)
Avail: NTIS HC $6.00/MF $0.95

The construction and utilization of a spherometer for controlling large aspherical surfaces of astronomical telescopes are described. ESRO

N71-37976# Recherches et Etudes d'Optique et de Sciences Connexes, Ballainvilliers (France).
SURFACE FINISHING OF THE ESO 3.654-m RITCHEY-CHRETIEN F/3 TELESCOPE MIRROR [SURFACAGE DU MIROIR ESO DE 3.654 METRES DE DIAMETRE RITCHEY-CHRETIEN F/3]
A. Bayle *In* European Southern Obs. Large Telescope Design Jun. 1971 p 229-250 In FRENCH (See N71-37960 24-14)
Avail: NTIS HC $6.00/MF $0.95

The surface finishing of ESO telescope mirror defects is performed, using a grinding machine. The performance characteristics of this concave mirror are listed. ESRO

N71-37977# Paris Observatory, Meudon (France).
PARASITIC LIGHT IN IMAGE CORRECTORS AND RECEIVERS [LUMIERE PARASITE DANS LES CORRECTEURS ET LES RECEPTEURS D'IMAGES]
P. Charvin *In* European Southern Obs. Large Telescope Design Jun. 1971 p 251-264 refs In FRENCH (See N71-37960 24-14)
Avail: NTIS HC $6.00/MF $0.95

A study of the parasitic light in the telescopes is made in view of preparing the 3.60-m French telescope. It examines the conditions to be fulfilled for improving the defectiveness and the photometric precision of Lallemand type electronographic receivers. Only the far parasitic light produced by the combination of an image receiver and a corrector is studied, and its role in different astronomical observation means is outlined. ESRO

N71-37978# Paris Observatory, Meudon (France).
LIMIT MAGNITUDES OF STARS MEASURABLE BY MEANS OF LARGE TELESCOPES [MAGNITUDES LIMITES DES ASTRES MEASURABLES AVEC LES GRANDS TELESCOPES]
Gerard Wlerick *In* European Southern Obs. Large Telescope Design Jun. 1971 p 265-272 refs In FRENCH (See N71-37960 24-14)
Avail: NTIS HC $6.00/MF $0.95

In telescope equipment the electronic camera, a photoelectric image receiver, makes use of the electronography which is well adapted to the photometry of weak stars and small galaxies. The limit magnitudes of some optically weak radio sources measured by means of large telescopes are determined. ESRO

N71-37979# Parsons (Grubb), Newcastle Upon Tyne (England).
THE COMPUTER ASSISTED FIGURING OF LARGE MIRRORS
D. S. Brown *In* European Southern Obs. Large Telescope Design Jun. 1971 p 273-278 (See N71-37960 24-14)
Avail: NTIS HC $6.00/MF $0.95

The use of a computer to assist in the figuring of large telescope mirrors is described. A mathematical model of the polishing process is necessary, and the range of techniques used must be restricted. The program written, which consists of four sections, is also described. ESRO

N71-37980# Hale Observatories, Pasadena, Calif.
LARGE TELESCOPE MOUNTS
Bruce H. Rule *In* European Southern Obs. Large Telescope Design Jun. 1971 p 283-297 (See N71-37960 24-14)
Avail: NTIS HC $6.00/MF $0.95

The evolutionary trends of large telescopes are outlined to help explain the current and future possible advanced mount technology. The telescope mount characteristics are then given

together with general mount requirements. The effect of optical parameters on mount stress are considered, and the elements of the telescope tube described. Structural aspects, analysis aids, and costs are discussed, and recommendations made. ESRO

N71-37981# Department of Education and Science, Canberra (Australia). Anglo-Australian Telescope Project Office.
OPTICAL PERFORMANCE CRITERIA FOR TELESCOPE TUBE DESIGN
J. D. Pope *In* European Southern Obs. Large Telescope Design Jun. 1971 p 299-313 (See N71-37960 24-14)
Avail: NTIS HC $6.00/MF $0.95

The types of deformation commonly encountered in the Serrurier truss tube used in modern large telescopes are described. The effects of these deformations on the optical performance of the telescope are examined, and it is shown how parametric equations can be derived which establish rational criteria for the design of tube components. Examples of deflections calculated for the Anglo-Australian telescope are given and these were applied to the parametric equations to show how the design criteria were met for this telescope. Author (ESRO)

N71-37982# Kitt Peak National Observatory, Tucson, Ariz.
HANDLING ASPECTS FOR LARGE TELESCOPES
L. D. Barr *In* European Southern Obs. Large Telescope Design Jun. 1971 p 315-323 (See N71-37960 24-14)
Avail: NTIS HC $6.00/MF $0.95

The handling problems of large telescopes are outlined and the steps involved in removing the Kitt Peak 4-m primary mirror in preparation for re-aluminizing are considered. The procedure is complex because of the restriction not to remove the mirror from its cell. Steps are suggested to avoid some of the problems. ESRO

N71-37983# Dilworth, Secord, Meagher and Associates, Ltd., Toronto (Ontario).
THE ENGINEERING DESIGN OF TELESCOPE STRUCTURES (WITH PARTICULAR EMPHASIS ON THE USE OF HIGH SPEED DIGITAL COMPUTERS)
E. Eggmann, J. C. Farrell, and L. C. Secord *In* European Southern Obs. Large Telescope Design Jun. 1971 p 333-349 (See N71-37960 24-14)
Avail: NTIS HC $6.00/MF $0.95

To achieve a high performance capability in a large telescope, a careful and thorough engineering analysis is necessary. A description is given of the use of a digital computer for telescope design with emphasis placed on the tube. ESRO

N71-37984# Kitt Peak National Observatory, Tucson, Ariz.
TELESCOPE BUILDING AND DOME DESIGN
W. W. Baustian *In* European Southern Obs. Large Telescope Design Jun. 1971 p 351-355 (See N71-37960 24-14)
Avail: NTIS HC $6.00/MF $0.95

The needs, planning, and design of buildings and domes for telescopes are outlined together with brief information relating to such aspects as costs, materials, support facilities, and shutters. ESRO

N71-37985# Hale Observatories, Pasadena, Calif.
DESIGN OF CASSEGRAIN CAGES
J. B. Oke *In* European Southern Obs. Large Telescope Design Jun. 1971 p 357-360 (See N71-37960 24-14)
Avail: NTIS HC $6.00/MF $0.95

The Cassegrain cage at the Hale 200-inch telescope is described, and the chair and method of access are discussed. The structural design of cages is considered, and the need for comfort is emphasized. ESRO

N71-37986# Hale Observatories, Pasadena, Calif. Astro-Electronics Lab.
COMPUTER CONTROL OF LARGE TELESCOPES
Edwin W. Dennison *In* European Southern Obs. Large Telescope Design Jun. 1971 p 363-371 (See N71-37960 24-14)
Avail: NTIS HC $6.00/MF $0.95

The computer control system for the Hale Observatory's telescopes is described. Among the items discussed are the system development, data system, control system, and circuits. ESRO

N71-37987# European Southern Observatory, Hamburg (West Germany).
TELESCOPE CONTROL BY ON-LINE COMPUTERS
S. Laustsen and B. Malm *In its* Large Telescope Design Jun. 1971 p 373-382 (See N71-37960 24-14)
Avail: NTIS HC $6.00/MF $0.95

The design and development for on-line computer control of the ESO 3.6-m telescope are described. The various control tasks of the computer such as focusing, guiding, etc. are outlined, and the main characteristics of the drive control are reviewed. ESRO

N71-37988# Texas Univ., Austin. Dept. of Astronomy.
PRESENT STATUS OF TELESCOPE DRIVES AND CONTROLS AT MCDONALD OBSERVATORY
D. N. Dittmer and J. E. Floyd *In* European Southern Obs. Large Telescope Design Jun. 1971 p 383-392 (See N71-37960 24-14)
Avail: NTIS HC $6.00/MF $0.95

The tracking drives of the 107- and 82-inch telescopes at McDonald Observatory are discussed. Due to work gear problems, a spur gear drive providing feedback control is being installed. The problems and circumstances that motivated the change are detailed, and several successful mechanical features of the 107-inch telescope are noted. ESRO

N71-37989# Institut National d'Astronomie et de Geophysique, Meudon (France). Div. Technique.
DRIVING THE FRENCH 2-m AND 3.60-m TELESCOPES FROM THE HORSESHOE
B. Bertin *In* European Southern Obs. Large Telescope Design Jun. 1971 p 395-414 (See N71-37960 24-14)
Avail: NTIS HC $600/MF $0.95

The mechanical aspects of telescope drives are considered. Among the topics discussed are: the driving of yoke mount telescopes from the horseshoe, taking into account natural frequency of the telescope; lack of gear rigidity, and gear deformation; the advantages and disadvantages of the worm-gear drive; and an examination of cylindrical gears. ESRO

N71-37990# Copenhagen Observatory (Denmark).
A DIGITAL TELESCOPE DRIVE SYSTEM
Nielsen R. Florentin *In* European Southern Obs. Large Telescope Design Jun. 1971 p 415-422 (See N71-37960 24-14)
Avail: NTIS HC $6.00/MF $0.95

The telescope drive system for an ESO 50-cm reflecting telescope intended for photoelectric observations is described. The system consists of two torque motors in a servo loop which has both digital and analog units. The computer control is discussed and the use of a flywheel on the motor axis explained. ESRO

N71-37991# Max-Planck-Institut fuer Astronomie, Heidelberg (West Germany).
COMPUTER CONTROL OF THE 2.2-m TELESCOPES
J. Solf *In* European Southern Obs. Large Telescope Design Jun. 1971 p 423-439 (See N71-37960 24-14)
Avail: NTIS HC $6.00/MF $0.95

The design of future 2.2-m telescope drive systems using integrated digital computers is summarized. The aspects considered include the telescope drive hardware (motor and

input devices), positioning under program control, and control of additional angular rates. ESRO

N71-37992# Hale Observatories, Pasadena, Calif. Astro-Electronics Lab.
A HIGH SENSITIVITY TV SYSTEM AS A VISUAL AID FOR OBSERVERS
Edwin W. Dennison *In* European Southern Obs. Large Telescope Design Jun. 1971 p 429-435 (See N71-37960 24-14)
Avail: NTIS HC $6.00/MF $0.95

An enhanced visual observation system is described, utilizing an image intensifier and television tube coupled together with fiber optic face plates. ESRO

N71-37993# Department of Education and Science, Canberra (Australia). AAT Project Office.
COMPUTER SUBSYSTEM OF THE ANGLO-AUSTRALIAN 150-INCH TELESCOPE
In European Southern Obs. Large Telescope Design Jun. 1971 p 437-444 (See N71-37960 24-14)
Avail: NTIS HC $6.00/MF $0.95

The computer subsystem forms an integral part of the Anglo-Australian telescope, and is concerned with both telescope control and astronomical instrumentation. These two computer applications are introduced, and the proposed computer configuration is described. ESRO

N71-37994# Department of Education and Science, Canberra (Australia). AAT Project Office.
ANGLO-AUSTRALIAN TELESCOPE PROPOSED DRIVE AND CONTROL SYSTEM
J. Rothwell *In* European Southern Obs. Large Telescope Design Jun. 1971 p 445-450 (See N71-37960 24-14)
Avail: NTIS HC $6.00/MF $0.95

The proposed drive and control system for the Anglo-Australian telescope is presented. The decision to use spur gears is discussed, and the torque motors are described. Other features such as the thyristor bridge amplifier, rate generator, and synchros are also described. ESRO

N71-37995# Zeiss (Carl), Oberkochen (West Germany).
ON DRIVE CONTROLS FOR ALTAZIMUTH MOUNTINGS
C. Kuehne *In* European Southern Obs. Large Telescope Design Jun. 1971 p 453-468 Sponsored by Bundesmin. fuer Bildung und Wiss. (See N71-37960 24-14)
Avail: NTIS HC $6.00/MF $0.95

The difficulties encountered in the use of altazimuth mountings and in the observation of stellar fields due to field radiation are outlined, and a method is described which overcomes the problems. The method consists of a plate holder carrier which is rotatably mounted in the telescope tube and can be shifted in two mutually perpendicular directions. ESRO

N71-37996# Groningen Rijksuniversiteit (Netherlands).
SOME ASPECTS OF DAYTIME OPERATIONS OF LARGE TELESCOPES
J. Borgman *In* European Southern Obs. Large Telescope Design Jun. 1971 p 471-476 (See N71-37960 24-14)
Avail: NTIS HC $6.00/MF $0.95

An analysis of the possibilities and problems connected with daytime operation of telescopes in the field of infrared astronomy is made. The atmosphere and infrared radiation are discussed, and nighttime infrared observation considered before a summary of daytime infrared observation is given. ESRO

N71-37997# Lick Observatory, Mount Hamilton, Calif.
DAYTIME AND OTHER UNANTICIPATED USES OF TELESCOPES
G. H. Herbig *In* European Southern Obs. Large Telescope Design Jun. 1971 p 477-485 (See N71-37960 24-14)
Avail: NTIS HC $6.00/MF $0.95

Astronomical requirements are proposed for incorporation in telescope design. The requirements include daytime and infrared operations, remote control, and a Coude laboratory. ESRO

N71-37998# Kitt Peak National Observatory, Tucson, Ariz.
COMMENTS ON A COUDE LABORATORY TELESCOPE
L. D. Barr *In* European Southern Obs. Large Telescope Design Jun. 1971 p 491-493 (See N71-37960 24-14)
Avail: NTIS HC $6.00/MF $0.95

A project is summarized which is intended to provide a good laboratory setup for more than one experiment and to bring the light beam to stationary experiments with the least number of reflections. ESRO

N71-37999# Hale Observatories, Pasadena, Calif. Astro-Electronics Lab.
A PHOTON COUNTING IMAGE RECORDER
Edwin W. Dennison *In* European Southern Obs. Large Telescope Design Jun. 1971 p 495-499 (See N71-37960 24-14)
Avail: NTIS HC $6.00/MF $0.95

A photon limited television system for viewing faint star fields is described. By connecting the system to a digital memory, it could then become a digital image recorder which would greatly enhance the capability of large telescopes. ESRO

N71-38000# McDonnell-Douglas Co., St. Louis, Mo.
OBSERVATIONS OF CATHODE TEMPERATURE EFFECTS IN ARGON AND AMMONIA ARCS
M. Sejbon and J. C. Kroutil Aug. 1971 15 p refs Original contains color illustrations
(MDC-Q0450) Avail: NTIS

An experimental apparatus with tungsten cathode and copper anode was constructed and operated to investigate the effect of cathode surface temperature on the behavior of argon and ammonia discharges from 0.3 to 65 torr. Steady-state operation was found to be possible only if the cathode surface temperature was kept above a critical value. This critical temperature was approximately 2940 K for argon and 3300 K for ammonia. Author

N71-38001# Cornell Univ., Ithaca, N.Y. Materials Science Center.
CONTINUOUS WAVE ULTRASONIC INTERFEROMETER TO MEASURE SMALL CHANGES IN THE VELOCITY OF SOUND OF MATERIALS
J. Paul Day, Paul S. Ho, and Arthur L. Ruoff 25 Jun. 1970 46 p refs
(Contract AT(30-1)-2504)
(NYO-2504-77; Rept-1389) Avail: NTIS

The different techniques used for measuring the transit time of sound waves in solids are briefly discussed. The design and operation of a continuous wave (cw) system for the measurement of elastic constants is described. The system precision is + or - 1 part per ten-million with an accuracy with respect to changes in the elastic constant of + or - 2 parts per ten-million. Data on the changes of C sub 11 and C sub 44 for niobium at liquid helium temperature as a function of magnetic field are presented to emphasize the capabilities of the instrument. Author (NSA)

N71-38002# Commissariat a l'Energie Atomique, Cadarache (France). Centres d'Etudes Nucleaires.
RAPID CONTAMINATION SIGNALING SYSTEM [SIGNALEUR DE CONTAMINATION RAPIDE DESCRIPTION - SOMMAIRE]
Andre Chaud, David Da Costa Vieira, Georges Friedling, Henri Suzan, and Claude Vieuxmaire Dec. 1970 29 p In FRENCH
(CEA-N-1417) Avail: AEC Depository Libraries

A device that enables the selection of an effective signal of

accidental contamination among parasite signals of natural contamination even if it is of low intensity is described. The principle used is a numerical filtering method according to the following formula: a sub t = a sub (t-1) + alpha(x sub t - a(sub t-1)). In this formula, the new a sub t filter output at the t time is computed from the a sub (t-1) last output at the t-1 time, to which a corrective term proportional to the difference between the new x sub t input and the a sub (t-1) last output is added. The appearance of an accidental contamination is reported when the x - a sub(t-1) difference exceeds a predetermined threshold. This device comprises an analog part which enables a normal monitoring of natural contamination. Designed for a 16 channel maximum capacity, the device has rather small dimensions: 5U standard frame. Author (NSA)

N71-38003# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
KT-27 CAMERA WITH LI-213 IMAGE ORTHICON TUBE
A. G. Gurtovnik et al 22 Mar. 1971 18 p refs Transl. into ENGLISH from Tekanika Kino i Televideniya (USSR), v. 14, no. 1, 1970 p 67-72
(AD-727251; FTD-HC-23-50-71) Avail: NTIS CSCL 17/2

Until now, the LI-201 camera tube has been used in studio cameras, especially the KT-27. The LI-201 image orthicon has a number of short-comings: high noise level, signal inhomogeneity over the field, poor image background, and high microphonic effect. Now a camera tube of improved design has been developed to replace the LI-201; it is the first to use the new technique of atomizing silver on the target. This has made it possible to increase the modulation factor of the beam, increase the useful signal, and reduce the afterimage signal. As indicated, the principal parameters of the LI-213 exceed those of the LI-201. Certain schematic changes and additions must be made in the KT-27 camera in order to realize the advantages of the LI-213 tube. Author (GRA)

N71-38004# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
HORIZONTAL IMAGE STABILITY AND THE GEOMETRIC PARAMETERS OF 35 MM MOTION PICTURE FILM
I. M. Mogilevskii 22 Mar. 1971 17 p refs Transl. into ENGLISH from Tekhn. Kino Televideniya (USSR), v. 14, no. 2, 1970 p 30-33
(AD-727252; FTD-HC-23-52-71) Avail: NTIS CSCL 14/5

The paper considers the relationship of defects in film dimensions to image instability, as well as the precision and stability of the dimensions themselves. This makes it possible to take into account in later cinematographic processes the cumulative instability introduced by the film. Author (GRA)

N71-38005# South Dakota School of Mines and Technology, Rapid City. Dept. of Physics.
INVESTIGATION OF CARBON RESISTORS AS CRYOGENIC THERMOMETERS
F. J. Kopp and T. Ashworth Jun. 1970 21 p refs
(Contract N00014-68-A-0160)
(AD-727187; TR-29) Avail: NTIS CSCL 14/2

Several specific types of carbon resistors (8 Allen-Bradley and 2 Speer) have been evaluated and compared as cryogenic thermometers. Author (GRA)

N71-38006# Army Test and Evaluation Command, Aberdeen Proving Ground, Md.
THEODOLITES Final Report on Material Test Procedure
1 Jul. 1971 16 p refs
(AD-727638; MTP-10-3-110) Avail: NTIS CSCL 17/8

The procedures describe test methods and techniques for evaluating the performance and characteristics of Theodolites, and for determining their suitability for service use by the U. S. Army. Author (GRA)

N71-38007# Picatinny Arsenal, Dover, N.J.
NEW INSTRUMENTATION FOR THE LIGHT OUTPUT MEASUREMENT OF PHOTOFLASH ITEMS
Louis R. Szabo Jun. 1971 38 p refs
(AD-727695; PA-TR-4213) Avail: NTIS CSCL 20/6

The major problem of measuring candlepower always has been associated with the use of properly corrected phototransducers. Many manufacturers of photodetectors claim to have cells corrected to the equivalent spectral response of the human eye; however, investigations of all these so-called corrected cells revealed that their correction to the ICI response is very crude. Only one manufacturer produces a cell with an acceptable correction, but it has limitations in time response, stability, and shelf life. It is therefore, a significant and necessary accomplishment to develop a light sensor which has an accurate and reproducible ICI correction, fast rise time, stability, and long shelf life. The project which is the subject of the report has accomplished these objectives. An accurate, low cost integrator also was developed in the program; it provides for the first time, a device which is specifically suited for use by all manufacturers of military light producing items. Author (GRA)

N71-38008# Iowa Inst. of Hydraulic Research, Iowa City.
A BI-DIRECTIONAL COUNTER FOR OPERATION WITH MODEL OLD GOLD HOT-WIRE ANEMOMETER SYSTEMS
John R. Glover May 1971 22 p
(Contract Nonr-1611(07))
(AD-727602; IIHR-131) Avail: NTIS CSCL 14/2

The bi-directional counter described in this report was designed specifically for operation with a bi-polar analog-to-frequency converter which has two independent pulse trains. The counter will count in either direction, cross zero and change the sign, and reverse the count direction automatically. Seven-segment readouts are driven by memory circuits which are updated at the end of each gate-time interval. The time-base oscillator is a 100-Hz crystal oscillator, and its output is divided by factors of ten to give gate times of 1, 10, and 100 seconds. The frequencies of the input pulse trains are divided by 10 or 100 for gate times of 10 to 100 seconds respectively. Thus, the four-unit displayed is constant for all three gate times. Author (GRA)

N71-38009# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE ELEMENTS OF MATHEMATICAL LOGIC AS APPLIED TO INTERPRETATION OF AERIAL PHOTOGRAPHS
L. E. Smirnov et al 17 Mar. 1971 20 p refs Transl. into ENGLISH from Vestn. Leningr. Univ., Ser. Geol. i geogr. (Leningrad), v. 25, no. 6, 1970 p 126-139
(AD-727489; FTD-MT-24-12-71) Avail: NTIS CSCL 14/5

The paper discusses the use of mathematical logic in the interpretation of aerial photographs. An example is given in the use of programmed instruction in the interpretation of aerial photographs. GRA

N71-38010# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
MEASURING DEVICES OF A COMPUTER CONTROL SYSTEM FOR AUTOMATING HEAVY DUTY POWER UNITS OF A THERMOELECTRIC POWER STATION
Yu. I. Semko et al 5 Feb. 1971 14 p Transl. into ENGLISH from the Russian
(AD-727481; FTD-HT-23-869-70) Avail: NTIS CSCL 14/2

In the development of computer controlled measuring devices a large number of factors dealing with the object to be automated should be considered. These include varying voltage, varying temperatures, the location of the equipment and how it is grounded. The equipment is provided with means for protection from overloads and other defects. Author (GRA)

N71-38011# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
A PORTABLE SPECTROGRAPH FOR MAKING SPECTRO-

PHOTOMETRIC MEASUREMENTS OF DISTANT OBJECTS
A. P. Galtsev et al 2 Jun. 1971 13 p refs Transl. into ENGLISH from Probl. Fiziki Atmosfery (USSR), 1969 p 184-188
(AD-727934; FTD-HC-23-329-71) Avail: NTIS CSCL 20/6

The portable spectrograph PS-2 was designed for making spectrophotometric measurements of objects located at considerable distances from the observation point under natural conditions with sunlight. The spectrograph gives the spectrum of the object being measured in the spectral region from 400 to 800 nm, a black and white photograph of the object and also a photograph of a clock dial which shows the time the measurements were made. In addition, a reference radiation source is built into the spectrograph. When a spectrophotometric measurement is made of this source through a step attenuator, it allows one to calibrate the photographic material and to obtain the measurement results in absolute units. Author (GRA)

N71-38012# Air Force Systems Command, Wright-Patterson AFB, Ohio.
DETERMINING THE INSTRUMENT CONSTANTS OF A CAMERA
A Kirichenko, G, et al 19 Apr. 1971 7 p refs Transl. into ENGLISH from Byul. St. Optich. Nablyudeniya Iskusstv. Sputnikov Zemli (Moscow), no. 51, 1968 p 19-20
(AD-727902; FTD-HT-23-193-71) Avail: NTIS CSCL 03/1

The constants of the camera UF ISZ-25-2 are determined and compared with the object positions obtained by calculations using three A. A. Kiselev methods. Author (GRA)

N71-38013# South Dakota School of Mines and Technology, Rapid City. Inst. of Atmospheric Sciences.
COMPARISON OF INFORMATION CONTENT OF SPACE PHOTOGRAPHY AND LOW ALTITUDE AERIAL PHOTOGRAPHY Final Report
Lewis H. Shapiro Jun. 1971 47 p refs
(Contract DI-14-08-001-12682)
(IR-USGS-229; USGS-DO-71-012) Avail: NTIS

Three problems are discussed. First it is shown, through the use of information theory, that the capability of space photography to transmit information compares favorably to that of conventional aerial photography. Secondly, results indicate that there is a significant overlap between the size of the smallest features which can be identified on the space photography and the larger features which can be identified on low altitude photography at scales of less than 1:15,000. Last is the determination of the geologic information content of space and conventional aerial photography. Author

N71-38014*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
METHODS AND PROCEDURES FOR EVALUATING, FORMING, AND INSTALLING SMALL DIAMETER SHEATHED THERMOCOUPLE WIRE AND SHEATHED THERMOCOUPLES
Robert J. Crowl and Herbert J. Gladden Nov. 1971 13 p refs
(NASA-TM-X-2377; E-6482) Avail: NTIS CSCL 14B

A discussion of the methods and procedures required for evaluating, forming, and installing reliable and durable small-diameter sheathed thermocouples is presented. The sheath diameters of interest are 0.025 and 0.50 cm. Topics discussed are limitations and problem areas, test characteristics and test procedures required, and some current installation methods, including laser-welding and flame-spraying. Results indicate that these methods and procedures can successfully reduce the failure rate of sheathed thermocouples from approximately 50 percent after 5 hours and 4 thermal cycles of testing to less than 20 percent after 40 hours and 12 thermal cycles of testing. Author

N71-38015 National Lending Library for Science and Technology, Boston Spa (England).
CALORIMETER FOR INVESTIGATING THE SPECIFIC HEAT OF AQUEOUS SOLUTIONS OF ELECTROLYTES AT ELEVATED TEMPERATURES
V. N. Sorokin et al [1970] 7 p refs Transl. into ENGLISH from Zh. Fiz. Khim. (Moscow), v. 44, no. 5, 1970 p 1347-1349
(NLL-CE-Trans-5634-(9022.09)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupons

Proposes a design of adiabatic calorimeter working on the continuous heat input principle, to investigate the specific heat of aqueous solutions of electrolytes up to 150 C. The calorimeter is calibrated for water. The specific heat of an 0.4816 m/solution of sodium chloride was measured. Good correspondence was found between the measured value of the apparent specific heat and the values supplied by the literature. Author

N71-38016 Pennsylvania State Univ., University Park.
THE ATOM PROBE FIM
John Andrew Panitz (Ph.D. Thesis) 1969 139 p
Avail: Univ. Microfilms Order No. 70-19443

The limits, capabilities, and operation of a field ion microscope are discussed. Results with a prototype and a refined instrument showed an unexpectedly high ionic charge for field evaporated tungsten, and confirmed the double charged ion predicted by field evaporation theory as the abundant species for most metals. The existence of adsorbed hydrogen as well as adsorbed noble imaging gases on a clean imaged surface has been demonstrated as well as the occurrence of metal-noble gas, and metal-hydrogen molecular ions. The zone line decorations of tungsten and iridium as well as some alloys have been successfully examined. Finally, the process of charge exchange, and the spatial dissociation of molecular ions originating on the surface have been considered. Dissert. Abstr.

N71-38585# Academy of Sciences (USSR), Moscow.
ABSOLUTE PHOTOMETRY OF COMET NUCLEI BASED ON THE FOCAL IMAGES OF STARS
K. I. Churyumov *In its* Proc. of the 6th Ann. All-Union Winter School on Space Phys., Part 2 1969 p 21 In RUSSIAN (See N71-38582 24-30)
Avail: NTIS

N71-38609# Academy of Sciences (USSR), Moscow.
ONE OF THE CRITERIA FOR QUALITY CONTROL OF A NEUTRON SUPERMONITOR
Ya. L. Blokh and I. N. Kapustin *In its* Proc. of the 6th Ann. All-Union Winter School on Space Phys., part 2 1969 p 115-116 refs In RUSSIAN (See N71-38582 24-30)
Avail: NTIS

N71-38615# Academy of Sciences (USSR), Moscow.
OPERATIONAL DATA FOR THE IRKUTSK COSMIC RAY STATION
M. A. Kovalenko and L. A. Shapovalova *In its* Proc. of the 6th Ann. All-Union Winter School on Space Phys., part 2 1969 p 129 In RUSSIAN (See N71-38582 24-30)
Avail: NTIS

N71-38618# Academy of Sciences (USSR), Moscow.
A HEAVY-LIQUID BUBBLE CHAMBER FOR COSMIC RESEARCH
L. V. Belonov, K. N. Yermakov, B. D. Lebedyev, A. V. Monakhov, V. I. Rozum et al *In its* Proc. of the 6th Ann. All-Union Winter School on Space Phys., part 2 1969 p 142-148 refs In RUSSIAN (See N71-38582 24-30)
Avail: NTIS

N71-38619# Academy of Sciences (USSR), Moscow.
MATERIALS FOR THE OPTICAL SYSTEMS OF CERENKOV AND SCINTILLATION COUNTERS
V. S. Chukin *In its* Proc. of the 6th Ann. All-Union Winter School on Space Phys., part 2 1969 p 147-148 refs In

RUSSIAN (See N71-38582 24-30)
Avail: NTIS

N71-38621# Academy of Sciences (USSR), Moscow.
A FIVE-CHANNEL WEAK-SIGNAL ANALYZER
V. V. Petrov *In its* Proc. of the 6th Ann. All-Union Winter School on Space Phys., part 2 1969 p 151-154 refs In RUSSIAN (See N71-38582 24-30)
Avail: NTIS

N71-38623# Academy of Sciences (USSR), Moscow.
FOSVICH-TYPE SCINTILLATION DETECTORS OF FAST NEUTRONS
V. V. Yuryev, A. M. Romanov, and Ye. V. Myskinin *In its* Proc. of the 6th Ann. All-Union Winter School on Space Phys., part 2 1969 p 156 In RUSSIAN (See N71-38582 24-30)
Avail: NTIS

N71-38624# Academy of Sciences (USSR), Moscow.
A MULTICHANNEL GAMMA SPECTROMETER FOR COSMIC RESEARCH
S. V. Golenetskiy, V. I. Ilinskiy, R. L. Aptekar, Yu. A. Guryan, Ye. P. Mazets et al *In its* Proc. of the 6th Ann. All-Union Winter School on Space Phys., part 2 1969 p 157 In RUSSIAN (See N71-38582 24-30)
Avail: NTIS

N71-38629# National Aeronautical Establishment, Ottawa (Ontario). Low Speed Aerodynamics Lab.
THE UNBOUNDED TURBULENT JET AS A TRANSDUCER ELEMENT
J. W. Tanney *In* NRC of Can. Quart. Bull. of the Div. of Mech. Eng. and the Natl. Aeron. Estab., 1 Apr. - 30 Jun. 1971 Jun. 1971 p 57-87 refs (See N71-38628 24-30)
Avail: NTIS

15 MACHINE ELEMENTS AND PROCESSES

Includes bearings, seals, pumps, and other mechanical equipment; lubrication, friction, and wear; manufacturing processes and quality control, and reliability; drafting; and materials fabrication, handling, and inspection.

N71-38017*# Aerojet-General Corp., Azusa, Calif. Power Systems Div.
DEVELOPMENT AND PRODUCTION OF EXPLOSIVELY BONDED 316SS/TANTALUM TUBING
C. G. Neitsch 21 Apr. 1970 54 p refs
(Contract NAS3-13458)
(NASA-CR-72981; AGC-TM-7972:70-622) Avail: NTIS CSCL 13H

Explosively bonded 316SS/tantalum tubing was developed and produced to support the bimetal-tube concept for the SNAP-8 boiler. It appears that the explosive tube-bonding fabrication process can produce tubing of adequate bond quality for a 40,000 hour boiler life. The pre-existing bond quality influences the debonding tendancy during simulated SNAP-8 boiler exposure. No correlation was found between the thermal exposure sequence and the debonding of explosively bonded tubing. Debonding during simulated SNAP-8 boiler exposure virtually stops after a 1400-hour incubation period. The 316SS/tantalum bond is therefore sufficient to withstand the tube deformation to be encountered in boiler fabrication without adverse effects. The ratio of 316SS bonding to tantalum bonding increased as experience in explosive-bond tube fabrication progressed. However, the effects of explosive bonding on the microstructure of 316SS compromises the use of this fabrication procedure. Simulated boiler testing indicates that the boiler no. 5 bimetal tube-butt joint is inadequate for boiler use. The preferred parameters for producing the most complete and the strongest bond between the 316SS and the tantalum are a 0.020 in. stand-off, a 7.8 grams/cu in. explosive density, and a one to 1/4 inch explosive thickness. Author

N71-38018*# Grumman Aerospace Corp., Bethpage, N.Y. Advanced Composite Group.
FABRICATION OF 1/3 SCALE BORON/EPOXY BOOSTER THRUST STRUCTURE, PHASE 1 Final Report, Jan. - Sep. 1971
Sep. 1971 82 p refs
(Contract NAS8-26675)
(NASA-CR-119958) Avail: NTIS CSCL 13H

The analytical methods, design techniques, materials, tooling, and various manufacturing processes associated with the fabrication of a one-third scale boron/epoxy tubular booster-thrust structure are described. Five specimens which confirm the adequacy of the integrally bonded boron/epoxy to titanium splice, and three full tubes with boron/epoxy center regions and titanium ends were fabricated and tested. The results verified the adequacy of the design and confirmed the forecast weight saving of 32 percent for the full tubes. An important aspect of the program was the nondestructive test techniques employed for quality control. E.M.C.

N71-38019*# General Dynamics Corp., Groton, Conn. Electric Boat Div.
DEVELOPMENT OF OPTIMUM TIG WELDING PROCEURE FOR PRODUCTION OF WELDMENTS IN 12 PERCENT NI MARAGING STEEL Final Report, 1 Jul. 1967 - 30 Jun. 1970
P. M. Schmidt and R. S. Snow Jul. 1971 248 p refs
(Contract NAS3-11183)
(NASA-CR-72981; PDE-154) Avail: NTIS CSCL 13H

An optimum gas-tungsten-arc (GTA) welding procedure has been developed for 3/4-inch-thick 12% Ni - 5Cr - 3Mo maraging steel and used to fabricate five 36-inch-diameter test vessels made of this material. Data is reported on the results of extensive studies of base metal, weld metal and weld heat-affected zone mechanical properties and fracture toughness. These studies included heat-treatment response studies of both base plate and weldments. Tensile, conventional Charpy, precracked Charpy, single-edge-notch, surface-flawed and metallographic specimens were tested and the five fabricated vessels were cyclically tested and burst. The results of these tests demonstrated that vacuum-melted 12% Ni - 5Cr - 3Mo maraging steel, welded using the developed gas-tungsten-arc welding procedure, is capable of meeting a leak-before-burst failure design criteria for 260-inch-diameter motor cases at a yield strength of 180,000 psi. Author

N71-38020*# Aerojet Liquid Rocket Co., Sacramento, Calif.
SPACE STORABLE OXIDIZER VALVE
R. L. Crocker 31 Aug. 1971 83 p refs
(Contract NAS3-12035)
(NASA-CR-72691; ALRC-CE-44) Avail: NTIS CSCL 13K

The design, fabrication, and testing of a 2.0-in., pneumatically-operated, metal-to-metal sealing, liquid fluorine shutoff valve is reported. Two valve assemblies were subjected to liquid fluorine flow tests. These valves were identical in design and fabrication, but one incorporated a gold-plated CRES 304L main seal and the other had a beryllium nickel main seal. The beryllium nickel material transferred to the valve seal during testing. Of the two, the gold-plated seal proved to be more satisfactory in over-all performance. Author

N71-38021*# AiResearch Mfg. Co., Los Angeles, Calif.
EXTERNAL PRESSURIZATION SYSTEMS FOR CRYOGENIC STORAGE SYSTEMS: DESIGN REFERENCE MANUAL

P. G. Wapato, A. W. Keeley, L. N. Jew, and C. F. Young
10 Sep. 1971 224 p refs
(Contract NAS9-10453)
(NASA-CR-115204; Rept-71-7535) Avail: NTIS CSCL 13D

The tools and techniques needed by system planners for estimation of the weight and cost of recirculation-type external pressurization systems for hydrogen, oxygen, and nitrogen storage are provided. Characterization information and design procedures are presented for all major system elements. These include energy addition devices, fluid-moving devices, transfer lines, and controls. Author

N71-38022*# Pratt and Whitney Aircraft, East Hartford, Conn.
DEVELOPMENT OF MAINSHAFT SEALS FOR ADVANCED AIR BREATHING PROPULSION SYSTEMS, PHASE 3 Final Report
V. P. Povinelli and A. H. McKibbin 25 Jul. 1971 111 p refs
(Contract NAS3-7609)
(NASA-CR-72987; PWA-4263) Avail: NTIS CSCL 11A

Five self-acting gas-film face seals for advanced gas-turbine engines were analyzed and four were tested. All five seal designs incorporated shrouded Rayleigh step lift pads at the primary seal surfaces to provide the gas-film lubrication. The wide pad and revised narrow pad seal were successfully operated at seal sliding speeds up to 500 ft/sec(17,300 rpm), pressure differential up to 300 psi, and gas temperatures up to 1200 F. The air leakages for both seals were in good agreement with calculated values and were about 1/10 of leakages expected from labyrinth seals at comparable conditions. The operating range of the narrow pad seal was limited due to insufficient film thickness. The ceramic seal suffered damage due to chipping during testing. Author

N71-38023*# Aerojet-General Corp., Azusa, Calif. Structural Composites Industries Div.
CYCLE TESTING OF BORON FILAMENT WOUND TANKS
R. J. Alfring, E. E. Morris, and R. E. Landes Aug. 1971 188 p refs
(Contract NAS3-12006)
(NASA-CR-72899) Avail: NTIS CSCL 13D

Filament tensile strengths and pressure-strain characteristics for a high-modulus, high-strength, boron-filament-wound/resin-composite pressure vessel were obtained at ambient and cryogenic temperatures, as were cyclic fatigue life relationships and strength retention after pressure cycling and long-term sustained pressurization. Filament tensile strengths as high as 354,000 psi (244,000 N/sq cm) were obtained in vessel burst testing; strains at vessel failure were about 0.4 to 0.5%. Author

N71-38024# Bendix Corp., Kansas City, Mo.
INVESTMENT CASTING TO ENHANCE PRODUCIBILITY: A CASE STUDY
W. E. Cromwell Mar. 1971 47 p refs
(Contract AT(29-1)-613)
(BDX-613-291) Avail: NTIS

A case is described where the investment casting process was successfully applied as a production method, replacing a formed sheet-metal welded assembly. The casting approach not only sharply improved the probability of insuring conformance with required design limitations, but also resulted in substantial program cost savings. When the geometry of a required metal product indicates potential fabrication problems or excessive machining cost, the investment casting approach may be the means to a successful product. Author

N71-38025# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE STABILITY OF THE CENTRAL EQUILIBRIUM POSITION OF THE JOURNAL IN A BEARING WITH GAS LUBRICATION
A. G. Burgvits et al 17 May 1971 17 p refs Transl. into ENGLISH from the book "Dinamika Mashin, Sbornik Statei" Moscow, 1969 p 82-88
(AD-727270; FTD-MT-24-89-71) Avail: NTIS CSCL 13/9

A study is given of the stability of the central equilibrium position of a gas bearing supported rotor, taking into account the inertia and compressibility of the lubricant. The additional pressure and sustaining force during motion of the center of the bearing pivot relative to the central equilibrium position are determined. It is shown that a stability limit exists only at Reynolds numbers greater than zero. A condition of stability as a function of the main parameters of the bearing is obtained, and the effect of these parameters on the location of the stability group is investigated. The necessity of taking the inertia of the gas lubricant into account in determining the stability is confirmed. GRA

N71-38026# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DETERMINATION OF THE PRINCIPLE PARAMETERS OF THE PROCESS OF STAMPING WITH LIQUID GASES
A. Ya. Azarevich et al 22 Apr. 1971 14 p ref Transl. into ENGLISH from Kuznechno-Shtampovochnoe Proizvod. (USSR), v. 12, no. 10, 1970 p 29-13
(AD-727247; FTD-HC-23-158-71) Avail: NTIS CSCL 13/8

Special stamping assemblies are used for stamping with liquid gases; they consist of an independent unit for supplying liquid gas to the die, the die itself, the control, measurement and safety apparatus, as well as feed elements for automating various working operations. This method of stamping is used primarily for making parts out of thin sheet material which are difficult or impossible to make on presses. Author (GRA)

N71-38027# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DETERMINATION OF THE RIGIDITY AND INELASTIC RESISTANCE OF TIRES IN A TANGENTIAL DIRECTION
A. D. Derbaremdiker et al 22 Jan. 1971 13 p refs Transl. into ENGLISH from Avtomob. Prom. (USSR), v. 36, no. 1, 1970 p 24-25
(AD-727470; FTD-HT-23-858-70) Avail: NTIS CSCL 13/6

A technique is described for determining the toughness and inelastic resistance of tires in a tangential direction. Results of experiments are presented. GRA

N71-38028# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THEORY OF MECHANISMS AND MACHINES (THEORY, EXAMPLE, GRAPHICAL OPERATIONS)
Sh. F. Margolin 22 Apr. 1971 537 p refs Transl. into ENGLISH of the publ. "Teoriya Mekhanizov i Mashin, Teoriya, Primery, Graficheskiye Raboty" USSR, 1968 p 1-357
(AD-727243; FTD-HC-23-510-70) Avail: NTIS HC $6.00/MF $0.95 CSCL 13/9

Two-dimensional mechanisms are investigated. In connection with this, among the mechanisms with lower kinematic couples only the mechanisms with the simplest structural Assur groups are given. Therefore, the classification of the structural groups and the corresponding classification of the mechanisms are presented in a somewhat simplified form. The structural groups with two components are referred to as Class 1, with four components as Class 2, etc. The mechanisms also are referred to by the corresponding classes. Mechanisms without structural groups which consist only of a driving component are referred to as mechanisms of the zero class. Author (GRA)

N71-38029# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
NUMERICAL METHOD OF SOLVING THE REYNOLDS EQUATION FOR A PRESSURIZED GAS BEARING
R. Z. Aliev et al 12 Feb. 1971 14 p Transl. into ENGLISH from Tr. Mekh. Protsessov Upr., Vychislitelnaya Mat. (USSR), no. 307, 1969 p 122-128
(AD-727162; FTD-HT-23-819-70) Avail: NTIS CSCL 13/9

The study is reported of a radial gas bearing of finite length with forced pressurization. A finite-difference method of solving the Reynolds equation for the pressures in the lubricant layer is outlined. The basic equations are obtained under the usual assumptions made in isothermal lubrication theory. The feed ports are schematized by continuous pressurization line. The results of computer calculations of the bearing characteristics are presented and analyzed. Author

N71-38030# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EFFECT OF CONTACT FRICTION ON WIDENING DURING FORGE DRAWING AND ROLLING
V. G. Berezin et al 19 Feb. 1971 15 p refs Transl. into ENGLISH from Tr. Politekhn. Inst. (USSR), no. 35, 1969 p 49-56
(AD-727164; FTD-HT-23-47-71) Avail: NTIS CSCL 13/8

Determinations were made of the dependence of widening and lengthening on feed in drawing under flat hammer blocks with different friction coefficients and also of the dependence of widening and lengthening on feed at different degrees of deformation. Reduced formulas and graphs indicate that the friction, both in rolling and in drawing, increases the widening only at large 'feeds', i.e., when the length of the area of deformation is greater than the width of the strip and decreases the widening when the length is smaller than the width.
Author (GRA)

N71-38031# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INFLUENCE OF ADDITIVE CONCENTRATION IN OIL ON THE WEAR OF HIGHLY LOADED SMALL-MODULE METRIC GEARS
G. V. Shipilov et al 29 Jan. 1971 11 p refs Transl. into ENGLISH from Neftepererabotka i Neftekhim. (Moscow), no. 10, 1969 p 20-22
(AD-727414; FTD-HT-23-889-70) Avail: NTIS CSCL 11/8

The document is concerned with the effect of the concentration of antiseizing and antiwear additives on the wear of heavily loaded friction pairs. The problem included determination of optimum concentration of additives sufficient to ensure minimum wear of gears in a real friction unit with a small-module metric gear. Author (GRA)

N71-38032# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DESIGN OF COMPRESSORS: AERODYNAMIC CALCULATIONS
A. N. Sherstyuk 26 May 1971 337 p refs Transl. into ENGLISH from the book "Osevye Kompressory: Aerodinamicheskii Raschet" 1955 p 1-250
(AD-727191; FTD-HC-23-781-70) Avail: NTIS CSCL 13/7

The book sets forth the foundations of the theory and design of axial compressors. Particular attention is devoted to compressors of stationary installations. The book is intended for engineers who design axial compressors. In addition, the book can be used by students in higher technical training institutions.
GRA

N71-38033# Reactive Metals, Inc., Niles, Ohio. Research and Development Dept.
THE MANUFACTURING OF AIRCRAFT-QUALITY HYDRAULIC TUBING WITH Ti-3Al-8V-6Cr-4Mo-4Zr ALLOY Final Report, 16 Jun. 1970 - 15 Jun. 1971
John M. Oleka, Louis J. Bartlo, and Howard B. Bomberger Wright-Patterson AFB, Ohio AFML Apr. 1971 77 p
(Contract F33615-70-C-1680)
(AD-727779; AFML-TR-71-111) Avail: NTIS CSCL 13/8

Manufacturing procedures were developed for producing high-quality tubing of the metastable beta titanium alloy Ti-3Al-8V-6Cr-4Mo-4Zr. In excess of 500 feet of tubing was produced and evaluated in each of the three sizes at 0.75-, 0.54- and 0.375-inch diameter. The Ti-3Al-8V-6Cr-4Mo-4Zr alloy was found to be a highly producible tubing material with mechanical properties better than those of other titanium tubing alloys. The producibility of Ti-38-6-44 is enhanced most significantly by proper thermal treatments at initial and intermediate tube sizes, proper reduction sequences and precise tooling arrangements. Ti-38-6-44 was found to offer a wide range of strength levels, as tubing, with excellent ductility. Yield strengths were measured from 120 to more than 200 ksi. Aged to 180 ksi yield strength, Ti-38-6-44 has about 14 percent elongation and a strength-to-weight ratio of 1,035,000 inches which is considerably greater than that of other hydraulic tubing alloys. Author (GRA)

N71-38034# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
METHODS OF SIMULATING DIMENSIONLESS WEAR OF MACHINE PARTS SUBJECT TO FRICTION
S. S. Slobodyannikov et al 19 Feb. 1971 12 p Transl. into ENGLISH from Izv. Vyashikh Uchebn. Zavedenii, Mashinostr. (USSR), no. 1, 1970 p 22-25
(AD-727209; FTD-HT-23-84-71) Avail: NTIS CSCL 13/9

The article outlines a procedure for calculating the wear of experimental friction couplings; the method is based on certain positions of technical cybernetics and 'black-box' strategy. The indicated procedure makes it possible to predict wear in the absence of information about physical and chemical processes in the contact zone. Author (GRA)

N71-38035# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
STUDY OF FINITE PLASTIC DEFORMATION IN COLD FORM ROLLING OF SPLINES ON SHAFTS
G. A. Smirnov-Alyaev et al 7 Apr. 1971 11 p Transl. into ENGLISH from Kuznechno-Shtampovochnoe Proizvod. (USSR), v. 12, no. 10, 1970 p 1-3
(AD-727926; FTD-HC-23-154-71) Avail: NTIS CSCL 13/8

The article presents data from an experimental investigation of the stress-deformed state of shafts as the result of cold form rolling of splines on them. A splined shaft is a part with a complex configuration in which the plastic deformation in the final state of forming is nonuniformly distributed through the cross section. Author (GRA)

N71-38036# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
BORONIZING OF MACHINE AND TOOL PARTS IN POWDERED MIXTURES
A. P. Epik et al 21 Jun. 1971 12 p refs Transl. into ENGLISH from Tekhnol. i Organizatsiya Proizv. (USSR), no. 2, 1970 p 69-71
(AD-727937; FTD-HC-23-342-71) Avail: NTIS CSCL 11/3

A technological scheme is presented for boronizing in saturating powder mixtures. Some data are given on the use of this method of boration for increasing the service life of machine parts and instruments. Author (GRA)

N71-38037# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INVESTIGATION OF THE SURFACE STATE OF A METAL IN A BOUNDARY LUBRICANT WITH ADDITIVES
B. I. Kostetskii et al 1 Mar. 1971 16 p refs Transl. into ENGLISH from Fiz.-Khim. Mekhan Materialov (USSR), v. 5, no. 5, 1969 p 559-564
(AD-727885; FTD-HC-23-870-70) Avail: NTIS CSCL 11/8

Based on the concepts as to the nature of external friction processes, the concepts secondary structure and boundary friction were founded. As an example are presented of the results of the investigation in the change in the surface state of a metal under the influence of additives of Fe or Cu thiocyanate in oil. Schematic models are presented of the structure of the surface layers under normal friction conditions, as well as of the hardening of the 1st and 2nd order. Author (GRA)

N71-38038# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
MAGNETOCONTROLLED ARC WELDING
Yu. G. Gegen et al 14 Jun. 1971 210 p refs Transl. into ENGLISH of the book "Svara Magnitoupravlyaemoi Dugoi" Moscow, Izdatelstvo Mashinostroyeniya, 1970 p 1-159
(AD-727868; FTD-MT-24-25-71) Avail: NTIS CSCL 13/8

The book gives an account of the physical characteristics and regularities of the interaction of a welding arc with a magnetic field under different conditions: an arc in an intrinsic magnetic field; an arc with a fixed active spot in a transverse and longitudinal magnetic field; an arc between parallel-located electrodes in a transverse magnetic field; an arc in a rotating magnetic field; and an arc between edges of pipes in a radial magnetic field. Examples of the practical use of magnetocontrolled arcs are given for the purpose of obtaining the necessary shapes, dimensions and density of the joint, depth of fusion, structure of the weld metal, transfer of filler metal into a molten pool and others. The book is intended for scientific and technical engineering workers engaged in the process of welding and for those interested in low-temperature plasma. GRA

N71-38039# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
IMPROVEMENT OF PLATE-ROLLING TECHNOLOGY
M. Ya. Brovman et al 3 Mar. 1971 23 p Transl. into ENGLISH from the book "Usoversh. Tekhnol. Prokatki Tolstykh Listov" 1969 p 4-21
(AD-727866; FTD-HC-23-868-70) Avail: NTIS CSCL 13/8

The significant increase in industrial construction, the rise in the production of welded structures, the expansion of machine building in the shipbuilding, energy and transport fields, and construction of large-scale pipelines have all increased the demand for steel plate and led to an expansion of its production. The output of steel plate in our country has increased steadily from year to year. The percentage of plate within the total output of rolled products has gradually increased. At the present time, nearly 60 percent of the rolled stock throughout the world is in the form of plate and strip. It is planned to increase output of plate by building new rolling mills while increasing the efficiency and qualitative characteristics of existing mills. Matters of considerable importance in this regard include saving metal by reducing unproductive losses in trimming and reducing the range of positive allowances in the geometric dimensions of the plate, as well as increasing the productivity of existing mills and the reliability of their equipment. The effort to improve the quality and reduce the mass of structures and parts made of steel plate has led to a sharp rise in the demands placed on quality and accuracy of the geometric dimensions of the plate.
Author (GRA)

N71-38040# Air Force Systems Command, Wright-Patterson AFB, Ohio.
TECHNOLOGICAL METHODS FOR ENSURING HIGH STRUCTURAL STRENGTH IN WELDED CONTAINERS MADE OF HIGH-STRENGTH THIN-SHEET STEELS
A. G. Simonik et al 5 Mar. 1971 14 p refs Transl. into ENGLISH from Tr. Mosk. Vysshee Tekhn. Uchilishche (Moscow), no. 133, 1969 p 14-21
(AD-727897; FTD-HT-23-87-71) Avail: NTIS CSCL 13/4

Using SP-43 steel as an example, the efficiency was shown of weld joints under two-directional extension in relation to welding technology, presence of weld joint rolling, and heat-hardening conditions. It was revealed that longitudinal and ring welds of cylindrical containers should be accomplished by different technologies. Author (GRA)

N71-38041*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PRELIMINARY STUDIES BY FIELD ION MICROSCOPY OF ADHESION OF PLATINUM AND GOLD TO TUNGSTEN AND IRIDIUM
William A. Brainard and Donald H. Buckley Washington Oct. 1971 56 p refs Original contains color illustrations
(NASA-TN-D-6492; E-6383) Avail: NTIS CSCL 11F

Adhesion experiments with platinum and gold contacting tungsten and iridium field-ionmicroscope emitter tips were conducted in vacuum. Platinum contacting tungsten at 300 K showed an ordered surface believed to represent mechanical transfer of the platinum onto the tungsten in an ordered manner. Gold contacting tungsten at 78 K showed essentially a random transfer with some clustering of gold atoms. Gold transferred onto iridium by contacting at 78 K presented an ordered appearance due to decoration of ledge sites by the gold atoms. Iridium contacted by platinum showed a highly ordered surface believed to be epitaxial transfer of platinum on the surface. Contacting iridium with platinum without vibration isolation caused large globs of platinum to transfer onto iridium in an ordered manner. Author

N71-38042 National Lending Library for Science and Technology, Boston Spa (England).
POSSIBILITIES FOR THE USE OF GLASS IN LUBRICATION
A. Rius et al 13 Apr. 1971 11 p refs Transl. into ENGLISH from the "Book Dedicated to Prof. D. Obdulio Fernandez" Madrid Rosasolano Inst. of Phys. Chem. CSIC, 1969
(NLL-RISLEY-Trans-2092-(9091.9F)) Avail: Natl. Landing Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The presence of powdered glass in lubricating oils appreciably reduces the risk of welding of the parts, reduces the friction factor in the initial stages considerably, reduces the wear, and has a favorable effect on the running-in processes. It is also evident that, in all this activation and use of glass, the mean size of the glass powder and the concentration of the glass dispersion, play a very important part. It is concluded that: (1) the addition of glass improves the lubricating properties of oils; (2) the size of the powder has a definite effect; and (3) up to a certain concentration, the lubricants efficiency of the glass is proportional to the concentration. Author

N71-38043 National Lending Library for Science and Technology, Boston Spa (England).
EXPECTED DEVELOPMENT OF METHODS FOR ENRICHING URANIUM IN EUROPE
H. L. Dreibigacker [1970] 9 p Transl into ENGLISH from the German In GERMAN and ENGLISH Presented at the Meeting on Mech. Flow Processes in Gas Centrifuges, DFVLR Colloq, Porz-Wahn, West Germany, 14 May 1970
(NLL-CA-Trans-249-(9091.9F)) Avail: Natl. Landing Library, Boston Spa, Engl.: 2 NLL photocopy coupons

Proper technical and economic comparison of the processes which might be considered for a European uranium enrichment plant is difficult because the diffusion and gas centrifuge methods are secret, and the gas centrifuge and separation nozzle methods are still at an early stage of development. The present technical and economic states of the three methods are described, and their potentials for development are re-assessed from the present-day point of view. The prospects of the three methods are qualitatively assessed and compared, particularly in view of the hoped-for European collaboration in the manufacture of enriched uranium. Author

16 MASERS

Includes applications of masers and lasers. For basic research see: 26 Physics, Solid State.

N71-38044*# Scientific Translation Service, Santa Barbara, Calif.
A METHOD OF STUDYING VERY WEAK PHASE OBJECTS [UNE METHODE D'ETUDE DES TRES FAIBLES OBJETS DE PHASE]

Henri Royer et al Washington NASA Oct. 1971 7 p refs Transl. into ENGLISH from Compt. Rend. (Paris), v. 270, 23 Feb. 1970 p 525-528
(Contract NASw-2035)
(NASA-TT-F-14008) Avail: NTIS CSCL 20E

A phase object is illuminated by means of a laser. It is analyzed by means of a half-wave lamina which is defocalized with respect to its Fourier plane. One or several fringes are observed in the image. Their deformations give an exact measure of phase gradients in the object. Author

N71-38045*# Techtran Corp., Glen Burnie, Md.
LASER MICROEMISSION SPECTROSCOPIC ANALYSIS OF METALS AND NONMETALS
T. Yamane et al Washington NASA Nov. 1971 14 p refs Transl. into ENGLISH from Bunko Kenkyu (Tokyo), v. 19, no. 3, 1970 p 147-154
(Contract NASw-2037)
(NASA-TT-F-13971) Avail: NTIS CSCL 20E

Spectrochemical analysis was studied with a laser microspectral analyser and a UV-spectrograph. An Nd-doped glass laser (output power was 1 Ws max) was used. The laser light was of normal pulse. Standard BAM steels and some nonconducting powders (spex mix diluted with graphite powder, and SiO2) which were solidified with pure phenolic resin were then analyzed. Electric discharge produced between auxiliary electrodes was used to strengthen the plasmas. Plumes from metals, nonconducting materials and various other samples were photographed to know their location from the samples surface and the electrodes. The position of plumes from the sample surface in metallic samples was lower than in nonconducting samples. Author

N71-38046*# Translation Consultants, Ltd., Arlington, Va.
INVESTIGATION OF THE MECHANISM OF MATTER INFLOW UNDER THE EFFECT OF LASER RADIATION [ISSLEDOVANIYE MEKHANIZMA POSTUPLENIYA VESHCHESTVA POD DEYSTVIYEM IZLUCHENIYA OPTICHESKOGO KVANTOVOGO GENERATORA (OKG)]
A. I. Korunchikov et al Washington NASA Oct. 1971 7 p refs Transl. into ENGLISH from Spectry., Trans. of the 4th Siberian Conf., 1965, Moscow, Nauka Press, 1969 p 226-230
(Contract NASw-2038)
(NASA-TT-F-13969) Avail: NTIS CSCL 20I

The effect of laser radiation on the inflow of matter was studied photographically on pure metals and on carbon. The outburst of plasma at the contact of a laser beam with the specimen took place in successive jets. The average velocity of the plasma was 5 to 12 kilometers per second depending on the melting point and the atmospheric mass of the specimen. The size of the flare increased and the radiation intensity decreased with decreasing pressure of the atmosphere surrounding the specimen. Author

N71-38047*# ITT Aerospace/Optical Div., San Fernando, Calif. Aerospace Labs.
DESIGN OF A SCANNING LASER RADAR FOR SPACEBORNE APPLICATIONS, PHASE 3 Final Report
Terry Flom and H. Dean Coombes Oct. 1971 147 p
(Contract NAS8-23973)
(NASA-CR-121014) Avail: NTIS CSCL 20E

A conceptual design of a scanning laser radar system is submitted which is to be used for acquiring and tracking cooperative targets (i.e., targets that have corner cube reflectors). The scanning laser radar acquires and tracks the target anywhere in a 30 deg x 30 deg field-of-view without the aid of mechanical gimbals, and has a maximum target range of 30-90 nautical miles depending upon the type of laser transmitter that is used. The system is designed to be relatively small, lightweight, and low-power consuming. The three configurations proposed differ primarily in the type of hardware that is allowed on the target vehicle. An analysis of the acquisition and tracking capability of the scanning laser radar and a laser power versus target range analysis is outlined in detail. A description of various techniques to determine target attitude with passive reflectors and an associated error analysis is provided. Subsections on the laser transmitter, beam steerer, receiver optics, receiver detector, and the associated radar electronics are also included. Author

N71-38048# Joint Publications Research Service, Washington, D.C.
RING LASER OPERATION
I. A. Andronova et al 22 Sep. 1971 10 p refs Transl. into ENGLISH from Izv. Vyssh. Uchebn. Zaved., Radiofiz. (Gorkiy), v. 14, no. 5, 1971 p 698-705 and 798
(JPRS-54106) Avail: NTIS

The problems associated with parasite retrodirective reflections in a ring resonator laser are discussed. Also discussed is the experimental study of the effect of these reflections on the characteristics of the laser in detuning the generation frequency along the amplification curve of the active medium. Experimental results are compared where possible with the given calculations. Author

N71-38049# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE PROBLEM OF FREQUENCY MODULATION OF THE EMISSION OF SOLID-STATE LASERS AND THE EXPERIMENTAL REALIZATION OF THE FREQUENCY SCANNING OF RUBY AND NEODYMIUM LASERS DURING THE LASING PROCESS
V. I. Kravchenko et al 23 Mar. 1971 22 p refs Transl. into ENGLISH from Kvantovaya Elektronika (USSR), no. 3, 1969 p 27-36
(AD-727250; FTD-MT-24-59-71) Avail: NTIS CSCL 20/5

A discussion is given of experimentally verified methods of controlling the frequency of solid-state lasers during their operation, with particular reference to the results obtained by Kravchenko, Soskin, and Tarasbrov (1967). The characteristics of the emission of such lasers are examined, and several useful applications of these lasers are noted. Author (GRA)

N71-38050# TRW Systems Group, Redondo Beach, Calif.
HOLOGRAPHIC CHARACTERIZATION FOR CERAMICS, PART 1 Final Report, 13 Mar. 1969 - 13 Dec. 1970
Terry V. Roszhart, Durk J. Pearson, and Jack R. Bohn 16 Feb. 1971 39 p refs
(Contract N00019-69-C-0228)
(AD-727160) Avail: NTIS CSCL 11/2

A study of the application of a group of pulsed ruby holographic techniques to a variety of ceramic materials testing problems was conducted. A pulsed ruby laser system capable of holographically imaging dynamic, large volume events is described. The system was coupled with holographic interferometry, microscopy, and correlation for application to residual stress measurements; property evaluation; crack propagation; nondestructive testing; long working distance microscopy; and large strain measurement. It is concluded that pulsed ruby holographic instrumentation will become a powerful, rugged, and sensitive tool for materials research and testing. Author (GRA)

N71-38051# Bell and Howell Co., Pasadena, Calif. Electronic Materials Div.
DEVELOPMENT OF GaAs INFRARED WINDOW MATERIAL Semiannual Report, 1 Dec. 1970 - 31 May 1971
Alan G. Thompson Jun. 1971 19 p refs
(Contract N00014-70-C-0132; ARPA Order 306; Proj. Defender)
(AD-726743) Avail: NTIS CSCL 20/6

The metallurgical, analytical, electrical and optical properties of semi-insulating GaAs were further investigated. Optimization of the 10.6 micron optical absorption coefficient continued. The measurement equipment involving a CO2 laser was improved so that the homogeneity of samples can be evaluated. Doping experiments in GaSb gave closely-compensated but not high resistivity material--the maximum resistivity observed at room

temperature was one ohm-cm. Evaluation of large diameter castings showed the need for a more controlled freezing surface, and plans have been made which will make this feasible.
Author (GRA)

N71-38052# Michigan State Univ., East Lansing. Dept. of Chemistry.
PLASMA FORMATION UPON LASER IRRADIATION OF TRANSPARENT DIELECTRIC MATERIALS BELOW THE DAMAGE THRESHOLD
B. E. Henderson, R. R. Getty, G. E. Leroi, and D. L. Rousseau (Bell Telephone Labs., Inc., Murry Hill, N. J.) Jul. 1971 13 p refs Presented at 3d Symp. on Damage in Laser Mater. Submitted for publication
(Contract N00014-68-A-0109-0009)
(AD-727143; TR-4) Avail: NTIS CSCL 20/5

The interaction of high power laser (ruby or neodymium-glass) radiation with ostensibly transparent materials has been the object of increasing research in recent years. Even at power levels below the threshold for either surface or internal damage, the emission of both positive and negative ions and of high energy radiation has been detected. Both linear and nonlinear absorption mechanisms have been proposed, and plasma initiation has been attributed to such factors as surface contaminants, surface defects, internal impurities, and free carrier absorption. In this paper, the experimental procedures, results, and interpretations of several of these investigations will be reviewed. Although the residual ion emission can be greatly reduced by careful pre-cleaning and handling procedures, it can not be eliminated entirely; the ramifications of this conclusion must be considered in the analysis of experiments in which damage is observed.
Author (GRA)

N71-38053# Purdue Univ., Lafayette, Ind. Dept. of Chemistry.
EFFICIENT LASER-PUMPED 10-MICROMETERS INFRARED QUANTUM COUNTER UPCONVERSION IN RARE EARTH DOPED CRYSTALS: MATERIALS AND PHENOMENON Annual Technical Report, 1 Jul. 1970 - 30 Jun. 1971
Francis K. Fong 30 Jun. 1971 169 p refs
(Contract DAHC15-70-G-0008)
(AD-727182) Avail: NTIS CSCL 20/6

From detailed theoretical considerations, it has been concluded that with Sm(3+) and Eu(3+) (or Sm(2+)) doped in soft single crystalline lattices and a strong optical laser pump, it is possible to achieve background-limited detection of 10-micrometers photons at 77K. It has been shown that in order to maximize the quantum efficiency of the upconversion process, it is necessary to minimize the multiphonon relaxation rates of the excited electronic states of the rare earth ions. Single crystals of SrCl2:Eu(3+) and SrCl2:Sm(3+):Eu(3+) (promising candidates as quantum counter crystals) have been grown by two different techniques. A new procedure has been developed for the oxidation of Sm(2+) to Sm(3+) in KCl in the preparation of quantum counter crystals such as KCl:Sm(3+):Sm(2+) and KCl:Sm(3+):Eu(3+). The quantum counter apparatus (consisting of a photon counting chamber, a CO2 laser, an argon ion laser, a dye laser, a mechanical chopper for phase-sensitive detection, and a PDP LAB 8 computer system) has been constructed and made fully operational.
Author (GRA)

N71-38054# Maryland Univ., College Park. Dept. of Electrical Engineering.
THE STUDY OF THE INTERACTION OF INTENSE PICOSECOND LIGHT PULSE WITH MATERIALS. INVESTIGATION OF TWO-PHOTON CONDUCTIVITY IN GALLIUM ARSENIDE USING A Nd: GLASS LASER Quarterly Technical Report, 19 Sep. - 18 Dec. 1970
Subramana Jayaraman and Chi H. Lee 18 Dec. 1970 40 p refs
(Grant DA-ARO(D)-31-124-70-G50; ARPA Order 878)
(AD-727755) Avail: NTIS CSCL 20/12

The report describes studies of photoconductivity in single crystal GaAs via two-photon absorption of light quanta from either a Q-switched or mode-locked Nd: glass laser. The results obtained with nanosecond light pulses are compared with those obtained with picosecond case. In the latter case, the transient response of the induced charge carrier accounts for the observed effects.
Author (GRA)

N71-38055# Army Foreign Science and Technology Center, Charlottesville, Va.
ELECTRO-OPTICAL LIGHT MODULATOR USING COUPLED RESONATORS [ELEKTROOP CHESKIY MODULYATOR SVETA NA SVYAZANNYKH REZONATORAKH]
R. A. Kazaryan et al 22 Jun. 1971 71 p refs Transl. into ENGLISH from Uch. Zap. Yerevanskogo Gos. Univ., Ser. Fiz.-Mat. Nauk (USSR), v. 104, 1967 p 63-68
(AD-727954; FSTC-HT-23-998-71) Avail: NTIS CSCL 20/6

A modulator containing two coupled coaxial resonators is described. Frequency characteristics of seperate resonators as well as of resonators connected by different coupling are given. It is shown that the two-resonator modulator provides a triple widening of the modulation band.
Author (GRA)

N71-38056# Air Force Systems Command, Wright-Patterson AFB, Ohio.
NONLINEAR OPTICS
Sergey Aleksandrovich Akhmanov 1970 35 p refs Transl. into ENGLISH from Priroda (Moscow), no. 3, 1970 p 32-41
(AD-727839; FTD-HT-23-29-71) Avail: NTIS CSCL 20/6

The laws of the interaction of high-powered laser radiation with a substance are substantially different from those for light of low intensity generated by ordinary sources. In the field of nonlaser light sources the optical properties of a substance do not ordinarily depend on radiation intensity (the optical characteristics - the refractive index, the degree of absorption and scattering, etc. - remain constant). In this case one speaks of linear optics. If there exists a dependence in the nature of the occurrence of optical effects in solids, liquids, and gases on radiation intensity, one is dealing with nonlinear effects. Eight years of intense development of a new field of physics - nonlinear optics - which appeared after lasers were created has led to a substantial expansion of the knowledge of the interaction of electromagnetic radiation with a substance and the creation of a number of generators spectral devices, and light receivers which are new to optics.
Author (GRA)

N71-38057# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EFFECT OF LASER ACTION ON THE EXOELECTRON EMISSION FROM THE SURFACE OF METALS
V. S. Kortov et al 5 Mar. 1971 13 p refs Transl. into ENGLISH from Fiz. Khim. Obrab. Mater. (Moscow), no. 1, 1970 p 3-7
(AD-727840; FTD-HT-23-93-71) Avail: NTIS CSCL 20/2

The effect of laser action on the surface of pure Au, Pt, Pd, Ni, and of alloys 1Kh18N9T and 40N25 was studied by the exoelectron emission method described previously (Kortov, et al., 1966). No emission was observed at room temperature. At higher temperatures thermoemission passed through a maximum Pt and Pd exhibited 2 peaks at different temperatures. Emission was due to laser action. Cracks and changes in relief and stresses occurred on the surface. The peaks of deformed specimens exposed to air decreased. This might be due to relaxation of stresses as well as to the deactivation of structural defects on the surface.
Author (GRA)

N71-38058 National Lending Library for Science and Technology, Boston Spa (England).
ON THE STRUCTURE OF A LASER PULSE REFLECTED BY THE SURFACE LAYER OF THE ATMOSPHERE
B. A. Kargin et al 1970 5 p refs Transl. into ENGLISH from Zh. Prikl. Spektroskopii, Akad. Nauk Belorussk. SSR (Minsk), v. 13, no. 1, 1970 p 46-49

(NLL-M-20353-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

Results of an experimental study on the structure of light pulses reflected by the atmosphere are compared to the results of calculations by the Monte Carlo method. It is concluded that the error in calculations by the Monte Carlo method does not exceed 10 to 20%, and the error in the experimental measurements is 10 to 30%. F.O.S.

N71-37802*# Northeastern Univ., Boston, Mass.
BIOPHYSICAL STUDIES
S. Fine *In its* Interrelations Between Advan. Process. Tech., Integrated Circuits, Mater. Develop. and Analysis 1 Jun. 1971 p 57-65 refs (See N71-37799 24-10)
Avail: NTIS

17 MATERIALS, METALLIC

Includes cermets; corrosion; physical and mechanical properties of materials; metallurgy; and applications as structural materials. For basic research see: 06 Chemistry. For related information see also: 18 Materials, Nonmetallic; and 32 Structural Mechanics.

N71-38059# Idaho Nuclear Corp., Idaho Falls.
PERFORMANCE OF TYPE 316 STAINLESS STEEL IN SODIUM-POTASSIUM EUTECTIC ALLOY DURING 32600 HOURS SERVICE
T. L. Hoffman [1971] 18 p refs Presented at the Natl. Assoc. of Corrosion Engineers High Temp. Symp., Chicago, Ill., 22 Mar. 1971
(Contract AT(10-1)-1230)
(Conf-710310-1) Avail: NTIS

The waste calcining facility utilizes a fluidized bed calciner for coverting highly radioactive aqueous waste into granular solids. Heat is supplied to this calciner by circulating sodium-potassium (NaK) eutectic alloy at 760 C through a bayonet heat exchanger in the fluidized bed of solids. Service test examinations of the stainless steel loop revealed the cumulative effects of 32,600 hours of operation at temperatures of 590 to 760 C during eight years service. The results showed that changes in mechanical properties and metallurgical effects occur with circulating nonisothermal NaK in contact with Type 316 stainless steel. Some mass transfer of alloying elements from the hot regions of the stainless steel loop to the colder regions was observed. The mitigation of these effects is discussed. Author (NSA)

N71-38060*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
STRESS CORROSION CRACKING OF ALUMINUM AND STEEL IN DIMETHYL DICHLOROVINYL PHOSPHATE
T. S. Humphries Sep. 1971 20 p refs
(NASA-TM-X-64617) Avail: NTIS CSCL 11F

The stress corrosion cracking (SCC) susceptibility of aluminum alloys 2024-T351 and 7075-T651 and 18 nickel maraging steel was evaluated in dilute solutions of dimethyl-dichlorovinyl phosphate (DDVP), distilled water, and 3.5 percent sodium chloride solution. Round tensile specimens stressed to 50 and 67 percent of the respective yield strengths were partially immersed in the test solutions. The results indicate that under these test conditions the stress corrosion cracking susceptibility of 2024-T351 and 7075-T651 aluminum and 18 Ni maraging steel are similar in distilled water and dilute solutions (0.001 to 0.1 percent) of DDVP. Although DDVP could not be considered to contribute to SCC at these concentrations, the test results do verify the susceptibility of the three alloys to SCC in aqueous solutions. Author

N71-38061# Atomic Energy Establishment, Cairo (Egypt). Dept. of Metallurgy.
EFFECT OF HEAT TREATMENT AND COLD WORK ON THE OXIDATION OF Zr-1 PERCENT Nb ALLOY IN AIR AND PRESSURIZED STEAM AT 450-650 C
I. A. El-Shanshoury, V. A. Rudenko, and M. E. El-Dahshan 1969 46 p refs
(UARAEE-72) Avail: AEC Depository Libraries

The effect of various treatments on the corrosion behavior of zirconium-1% Nb alloy was studied in air and pressurized steam at 450 to 650 C. Cold rolled alloy was found to show the best corrosion resistance in air and pressurized steam. Annealing of the alloy at 900 C resulted in higher weight gains during corrosion tests. The initial stages of the corrosion process in air and steam follow the parabolic rate law. The activation energies were calculated to be 38.5 and 26.3 kcal/mole for air and steam respectively. The activation energy of the process was independent of the treatment. The only variable is the constant of the Arrhenius equation. Differences in oxidation rates were attributed to the differences in the structure of the alloy due to treatment. Author (NSA)

N71-38062# Bhabha Atomic Research Centre, Bombay (India).
SPECTROGRAPHIC DETERMINATION OF LEAD AND TELLURIUM IN Bi-Pb AND Bi-Te ALLOYS
P. Sreerama Murty and P. P. Khanna 1971 9 p refs
(BARC-533) Avail: AEC Depository Libraries

A spectrographic method is described for estimation of lead and tellurium in their alloys with bismuth in the concentration range of 0.002 to 0.1% for lead and 0.02 to 0.8% for tellurium. The sample is ground with spec-pure conducting graphite powder in the ratio 1:1 by weight and 15 mg of the mixture is arced in a dc and by spectra are photographed in the region 2300 to 3050 A. Pb 2614.2 A and Te 2385.8 A are chosen as analytical lines while Bi 2582.2 A and Bi 2448.1 A, respectively, served as internal standard lines. The precision of the method is about ± or - 10%. Author (NSA)

N71-38063# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Material- und Festkoerperforschung.
REPORT ON THE QUESTION OF THE MOST ADVANTAGEOUS EXCITATION VOLTAGE FOR X-RAY MICROANALYSIS [EIN BEITRAG ZUR FRAGE NACH DER GUENSTIGSTEN ANREGUNGSSPANNUNG BEI DER ELEKTRONENSTR HL-MIKROANALYSE]
W. Hein 10 Dec. 1970 37 p refs In GERMAN; ENGLISH summary
(NP-19687) Avail: AEC Depository Libraries

For X-ray microanalysis 3 to 4 times the critical excitation voltage is frequently applied as the most advantageous excitation voltage. In pure elements a favorable excitation voltage can be determined approximately from an equation, which was calculated according to measurements from a straight line on double logarithmic paper. Some elements in alloys and d combinations show partly their maximum intensity in values of about 10V sub Kr. Other elements do not show a change in contrast to pure elements. For determination of the most advantageous excitation voltage impulse, measurements in relation to the excitation voltage must be carried out. Author (NSA)

N71-38064# European Atomic Energy Community, Ispra (Italy). Materials Dept.
LABORATORY GUIDE FOR THE SELECTION OF BRAZING MATERIALS
C. Cappelletti 1971 14 p refs
(EUR-4637-e) Avail: AEC Depository Libraries; EUR F.Fr. 4.45

Orientating experiments were carried out on the wetting of various metals by different brazing alloys. The difference of behavior of refractory metals submitted to brazing at low temperature and at high temperature is noted. In the first case wetting will be obtained by adding small amounts of metal, which alloys easily with the base metal (mainly Ni). In the other case, the compatibility between the brazing metal and the base

metal plays its own important role. In order to avoid a too vigorous attack of the base metal, a judicious choice of the geometry of the parts to be joined and of the right brazing procedure is necessary. Author (NSA)

N71-38065*# Institute of Nuclear Research, Warsaw (Poland).
PROPERTIES OF STAINLESS STEEL 1H18N9T AFTER AGING IN THE POWER REACTOR TEMPERATURE RANGES. PART 2: MICROSTRUCTURE
F. Seyna, E. Mizera, and M. Chyczewski 1970 12 p refs In POLISH
(INR-1255) Avail: AEC Depository Libraries

Metallographic examinations of the material in the initial and aged condition were carried out by optical and electron microscopy techniques. The experimental results are discussed. Author (NSA)

N71-38066*# Boeing Scientific Research Labs., Seattle, Wash. Materials Science Lab.
STRESS CORROSION CRACKING OF TITANIUM ALLOYS: SCC VELOCITY: CONCENTRATION OF TiCl3 Quarterly Progress Report, 1 Oct. - 31 Dec. 1970; Summary Report, 1 Jul. - 31 Dec. 1970
T. R. Beck and M. J. Blackburn Dec. 1970 39 p refs
(Contract NAS7-489)
(NASA-CR-123165; QPR-18) Avail: NTIS CSCL 11F

Stress corrosion cracking velocity in region II of titanium alloys varied as the 1/4 to 1/2 power of halide ion concentration at high concentrations in both water and methanol. An approximately linear relation of velocity to potential was observed for Ti:8-1-1 in a methanol solution of LiCl and for three other alloys in aqueous solution. Velocity versus stress intensity factor data were obtained for Ti-8Mn, Ti-11.5Mo-6Zr-4.5Sn, Ti-8Mo-8V-3Al-2Fe, and Ti-13V-11Cr-3Al alloys. Calculations were made of TiCl3 concentration in a propagating crack based on kinetics data for formation of Ti(+3) at freshly generated titanium surfaces. Author

N71-38067# United Kingdom Atomic Energy Authority, Harwell (England).
STUDY OF THE BEHAVIOR OF ZIRCONIUM ALLOYS IN WATER AND STEAM-WATER MIXTURES IN THE MR REACTOR LOOPS
A. D. Amaev et al Feb. 1970 13 p refs Transl. into ENGLISH from Russian rept. IAE-1926 Presented at Joint UK/USSR Seminar on the Operation and Use of Res. and Testing Reactors, Harwell, Engl., Oct. - Nov. 1969
(LB/G-3006; Conf-691060-2; IAE-1926) Avail: AEC Depository Libraries

Results are presented of an investigation of Nb-Zr and Nb-Ni-Zr alloys after tests in pressurized water and a steam-water mixture in the MR reactor loops. The tests were carried out on samples of tubes and fuel-element rods of different design. It was found that irradiation caused a marked deterioration in the properties of the Nb-Ni-Zr alloy. Under the same conditions the Nb-Zr alloy was far less sensitive to irradiation. Author (NSA)

N71-38068*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ARC JET TESTS OF METALLIC TPS MATERIALS
Frank J. Centolanzi, Hubert B. Probst, Carl E. Lowell, and Norman B. Zimmerman 15 Oct. 1971 32 p refs Presented at the Space Shuttle Mater. Conf., Huntsville, Ala., 5-7 Oct. 1971; Sponsored by the Soc. of Aerospace Mater. and Process Engr. Prepared jointly with NASA, Lewis Res. Center, Cleveland
(NASA-TM-X-62092) Avail: NTIS CSCL 11F

Seven thoria dispersed nickel base alloys and one cobalt base alloy, candidates for the Metallic Thermal Protection System for the space shuttle vehicle, were tested simultaneously in an arc jet at a nominal test temperature of 1366 K (2000 F) and pressure of 0.01 atmospheres. The degradation of the materials after 50 one half-hour cycles in the arc jet simulating space shuttle entry conditions was determined utilizing techniques including X-ray diffraction, metallography, and electron beam microprobe. Author

N71-38069*# Texas A&M Univ., College Station. Engineering Experiment Station.
STRAIN RATE SENSITIVE CONSTITUTIVE EQUATIONS
Charles E. Nelson (M.S. Thesis) and James L. Rand Aug. 1971 93 p refs
(Grant NGR-44-001-106)
(NASA-CR-123175; TEES-9075-CR-71-001) Avail: NTIS CSCL 11F

The constitutive equations are analytic relations between stress and strain. The developed equations make use of a yield criterion which incorporates the second and third invariants of the stress deviator. The deviator defines a materials' change in shape. The resulting equation is applicable to any type of stress tensor. Values of stress and strain under uni-axial and torsional states of stress for various strain rates are generated. Stress-strain behavior at various strain rates is predicted for copper, lead, Al 1100 (99.00% pure), Al 1060-0 (99.60%), Annealed Aluminum (99.995%), and High Purity Al (99.997%). With the incorporation of rate sensitivity into the constitutive equations, a material's response to strain rates of 1 million/sec and higher is predicted. A comparison is made between the response predicted by the constitutive equations and published experimental results. Good agreement exists at high strain rates, but as the dynamic strain rate approaches the static value small amounts of error are incurred. Author

N71-38070*# IBM Watson Research Center, Yorktown Heights, N.Y.
DEVELOPMENT OF ALUMINUM ALLOY COMPOUNDS FOR ELECTROLUMINESCENT LIGHT SOURCES
R. J. Chicotka, L. M. Foster, M. R. Lorenz, A. H. Nethercot, and G. D. Pettit 31 May 1971 54 p refs
(Contract NAS12-2169)
(NASA-CR-111976) Avail: NTIS CSCL 11F

Continuing research is reported in a program aimed at improving the visibility of electroluminescent diodes. The approach taken was to develop an aluminum alloy semiconductor material having a band gap substantially larger than the optimum frequency at which the human eye has its maximum sensitivity, and which could be doped with efficient radiative recombination centers so that the emitted light would have the optimum frequency. Two materials considered in the investigation are the ternary alloys (Ga,Al)P and (In,Al)P. Accomplishments reported include: preparation of these wide band gap semiconductors and determination of their physical properties, work done on the fabrication of diode structures from the alloys, and calculations of the electrical and light emitting properties of these diodes. D.L.G.

N71-38071*# Boeing Co., Seattle, Wash.
CHARACTERIZATION OF POROUS POWDER METAL MATRICES FOR TRANSPIRATION COOLED STRUCTURE Interim Report
R. E. Regan Oct. 1971 51 p refs
(Contract NAS3-12012)
(NASA-CR-72994) Avail: NTIS CSCL 11F

Porous powder metal parts produced from spherical stainless steel or copper powders were characterized to assure their suitability for use in transpiration cooling experimentation. Characterization of the powder metal matrices included chemical analysis, radiographic inspection, mercury porosimetry and analysis of microstructure. A description of the experimental and analytical techniques is reported along with the data generated. Author

N71-38072# California Univ., Los Angeles. Dept. of Materials.
STRAIN HARDENING EQUATIONS AND UNIFORM STRAIN Vanadium Alloy Development Topical Report
K. ONO Feb. 1971 10 p refs

(Contract AT(04-3)-34)
(UCLA-34-P-177-5) Avail: NTIS

The load carrying capacity of a structural member in tension is dictated by its work-hardening characteristics. It can be easily shown that, when the maximum load is reached, stress equals differential of stress divided by differential of strain. Further plastic deformation proceeds locally and the necking starts. The amount of true strain before the necking occurs is called uniform strain. In terms of engineering strain, the corresponding quantity is uniform elongation. It is well known that when the stress-strain curve of a material can be described by the power law, stress equals constant multiplied by stress raised to the mth power. This power law relationship has been most commonly employed in describing experimental data and in theoretical calculations.
Author

N71-38073# California Inst. of Tech., Pasadena. W. M. Keck Lab. of Engineering Materials.
AN APW CALCULATION OF ENERGY BANDS IN SIMPLE CUBIC TELLURIUM
L. R. Newkirk and C. C. Tsuei May 1971 12 p refs
(Contract AT(04-3)-822)
(CALT-822-29) Avail: NTIS

The metastable simple cubic phases of TeAu and TeAg were investigated over a wide range of compositions extending as high as 85% Te. A consideration was made of the band structure of hypothetical simple cubic Te which predicts electrical properties quite different from those of normal Te. Comparison of the metallic conductivity and the possibility of a superconducting transition with the observed properties of the phase of Te which forms at 40 kB suggests that the structure of this phase may be more closely related to the simple cubic lattice than a cursory examination of the X-ray data indicates. To perform APW calculations, a reasonable value for the lattice spacing was obtained by extrapolation of the TeAu and TeAg experimental data.
J.G.M.

N71-38074# Iowa State Univ. of Science and Technology, Ames.
STUDY OF THE VANADIUM-OXYGEN SYSTEM
David George Alexander (M.S. Thesis) Jun. 1971 58 p refs
(Contract W-7405-eng-82)
(IS-T-448) Avail: NTIS

A phase diagram is proposed for the V-VO system based on melting point determinations, differential thermal analyses, metallographic observations, and X-ray parametric measurements. A eutectic reaction occurs at 1640 C and 11.4 wt % oxygen. The intermediate phases, V9O and V2O, form peritectoidally at 510 and 1185 C, respectively, while V4O forms by a peritectic reaction at 1665 C. The VO phase melts congruently at 1790 C. The terminal solubility of oxygen in vanadium increases from 1.0 wt % at room temperature to a maximum of 6.0 wt % at the peritectic temperarure. There is also extensive solid solubility associated with each of the intermediate phases. A martensite-like phase forms in alloys in the composition range 2 to 3 wt % oxygen upon quenching from above the 510 C peritectoid horizontal.
Author (NSA)

N71-38075# Bettis Atomic Power Lab., Pittsburgh, Pa.
FRACTURE TOUGHNESS OF LOW-STRENGTH STEELS
D. J. Semaw, G. P. Kallenberg, and R. J. Towner May 1971 143 p refs
(Contract AT(11-1)-GEN-14)
(WAPD-TM-895) Avail: NTIS

The recent fracture-toughness data on low-strength steels either obtained by Bettis or reported in the literature are summarized. The data are first analyzed with respect to technical advances in the state of the art of fracture-mechanics measurement techniques, and second, presented as a compilation of the significant data available for low-strength steels. The grades of steel included are: A302B, A533 Grade B, A508 Class 2, and A508 Class 4. The data include both static and dynamic loaded specimens. Irradiated materials fracture-toughness tests and tests on weld and heat-affected-zone materials are included.
Author (NSA)

N71-38076# Dow Chemical Co., Golden, Colo. Rocky Flats Div.
POSSIBILITY OF HAZARDOUS ENVIRONMENTAL PLUTONIUM RELEASES
Douglas C. Hunt 14 Apr. 1971 37 p refs
(Contract AT(29-1)-1106)
(RFP-1543) Avail: NTIS

A study was made of the possible hazard outside an enclosure which could be caused by uncontrolled oxidation of plutonium within the enclosure. The existent observational data on such restricted plutonium release are reviewed and a release model relating the free-release source strength (i.e., the source strength outside the enclosure) and the parameters describing the release is constructed. Based on both the observational data and the model calculations, the conclusion follows that restricted release is unlikely to lead to dangerous free releases of a plutonium aerosol. The model calculations specifically show that the maximum credible accident assumed would be safe by about 2 to 5 orders of magnitude. However, the calculations indicate that maximizing either the plutonium release rate or the asymptotic temperature reached in an enclosure can cause a free release exceeding the safe rate.
Author (NSA)

N71-38077# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Material und Festkoerperforschung.
LONG-TIME CORROSION INVESTIGATION OF AUSTENITIC Cr-Ni STEEL AND NICKEL-BASE ALLOYS IN SUPERHEATED STEAM (620 C, 1 atm) WITH SPECIAL ATTENTION TO THE BEHAVIOR OF COLD FORMED MATERIAL SURFACES [LANGZEITIGE KORROSIONSUNTERSUCHUNGEN VON AUSTENITISCHEN CRNI-STAEHLEN UND NICKELBASISLEGIERUNGEN IN HEISSDAMPF (620 C, 1AT) UNTER BESONDERER BERUECKSICHTIGUNG DES VERHALTENS KALTVERFORMTER MATERIALOBERFLAECHEN]
S. Leistikow, H. v. Berg, and E. Pott Feb. 1971 73 p refs In GERMANY; ENGLISH summary
(KFK-1301) Avail: AEC Depository Libraries

Seven superheat materials were tested in semidynamic steam loop experiments at 620 C and 1 atm during 5000 hours and in three different surface or bulk conditions. The experiments were evaluated by gravimetric measurements, chemical analysis of the steam condensate, and metallography. The experiment results verified the increased corrosion resistance of annealed nickel alloys and the effects of increasing oxidation rates on chromium depleted surfaces or coarse grain structures. Cold worked specimens of all alloys tested corroded uniformly and to an extent which was strongly diminished in the case of the CrNi steels. The high corrosion resistance which was built up by selective chromium diffusion and oxidation proved its long-time effectiveness through 10.000 hr of testing.
Author (NSA)

N71-38078# Kernforschungsanlage, Juelich (West Germany). Inst. fuer Reaktorwerkstoffe.
CORROSION PROPERTIES OF STEEL IN STATIONARY MOLTEN LEAD [KORROSIONSVERHALTEN VON STAEHLEN IN STATIONAEREN BLEISCHMELZEN]
I. Ali Khan Sep. 1970 83 p refs In GERMAN
(JUL-694-RW) Avail: AEC Depository Libraries

The corrosion behavior of forty chromium and chromium-nickel steels in molten lead was investigated at 575, 650, and 750 C for a period of 3250 hr. The study shows that the corrosion of the Cr-Ni steel is not caused by the higher solubility of the Ni in the Pb, but by the intercrystalline corrosion attack with the precipitation of chromium carbide at the austenite grain boundaries. Since the chromium carbide is precipitated at lower temperature in increasing mass at the grain boundaries, higher corrosion attack was observed at 575 C. The steels with higher Ni content as X5CrNi 12/12 and X5CrNiMo 17/13 show up to 750 C lower corrosion attack than the corresponding 18/8 Cr-Ni

steels. This is attributed to the increase of the solubility of the austenite in the Cr by increased Ni content of the steel. The non-stabilized and stabilized Cr-Ni steels with Mo additions in bend tests show stronger corrosion attack than the steels without Mo additions. Author (NSA)

N71-38079# Danish Atomic Energy Commission, Risoe. Research Establishment.
DISPERSION-STRENGTHENED ALUMINUM PRODUCTS: MANUFACTURE, STRUCTURE AND MECHANICAL PROPERTIES
Niels Hansen Mar. 1971 151 p refs
(RISO-223) Avail: AEC Depository Libraries

Dispersion strengthened aluminum and aluminum oxide products were examined with a view to their nuclear application and in order to study the relationship between microstructure and mechanical properties. Products were examined as recrystallized, in the extruded condition, and after cold drawing. Dispersion-strengthened aluminum products with mechanical properties comparable to those of sintered aluminum products can be manufactured from blends of fine and unagglomerated aluminum and oxide powders. For low-oxide aluminum aluminum-oxide products (0.2 to 4.7 weight percent aluminum oxide), grain (subgrain)-boundary strengthening and oxide-dispersion strengthening are superimposed. The strengthening effect of grain boundaries and subgrain boundaries is the same as found in aluminum. The strain-hardening rate at room temperature at small plastic strains depends on the oxide phase parameters as predicted in Ashby's work-hardening model. For great strains the strain-hardening rate is practically not affected by the presence of oxide. Author (NSA)

N71-38080# Lyon Univ. (France). Faculte des Sciences.
OXIDATION KINETICS OF PURE OR ALLOYED ZIRCONIUM WITH OXYGEN OR WATER VAPOR [CONTRIBUTION A L'ETUDE DU MECANISME D'OXYDATION DU ZIRCONIUM PUR OU ALLIE PAR L'OXYGENE ET LA VAPEUR D'EAU]
Michel Leclercq (Ph.D. Thesis) 1969 177 p refs In FRENCH
(NP-18833) Avail: AEC Depository Libraries

The various isothermal oxidation stages of very pure Zr were studied in the temperature range 600 to 800 C under oxygen pressures of 6, 10, and 16 torr for limited reaction times (320 min). The observation of the oxide layer growth and thickness as a function of time by metallographic microscopy and of the oxygen penetration depth by microhardness measurements were made under the same conditions. The Zr-water vapor, Zircaloy-2-O2 and Zircaloy-2-water vapor couples were studied. A theoretical model taking the competitive processes of oxygen diffusion into account was established and compared to metallographic and microgravimetric results. Oxygen diffusion coefficients in zirconia and zirconium were measured with this model and by microhardness measurements. The oxidation process was investigated under thermodynamically reversible conditions. The metal was subjected to gas pressures lower than 10 to the minus 6th power torr. The pressure variations near the metallic filament, rapidly heated by Joule effects to a high temperature, are plotted. NSA

N71-38081# Kernforschungsanlage, Juelich (West Germany). Inst. fuer Reaktorbauelemente.
MEASUREMENT OF THE TEMPERATURE WITH METAL MONITORS USING SURFACE TENSION IN THE RANGE 780 C TO 1555 C [DIE MESSUNG VON TEMPERATUREN MIT METALL-MONITOREN UNTER AUSNUTZUNG DER OBERFLAECHENSPANNUNG IM BEREICH VON 780 BIS 1555 C]
K. H. Presser Jul. 1970 45 p refs In GERMAN
(JUL-680-RB) Avail: AEC Depository Libraries

The form alteration temperature of metal monitors was exactly determined experimentally under clearly defined and reproducible conditions of the heating in hydrogen, rare gas, and air atmospheres. In the range between 780 and 1555 C the pure metals Ag, Au, Cu, Ni, and Pd and the binary alloys Ag/Pd, Au/Pd, Cu/Pd, Ag/Au, Ag/Cu, Au/Cu, and Cu/Ni are suitable for monitors. With attainment of the form alteration temperature, the surface tension change induces form alteration completion in several seconds. The material to be melted assumes a spherical form with high probability. The form alteration temperature in the pure metals is practically identical with the melting temperature and in metal alloys it reaches values which deviate a maximum of + or - 2% from the liquidus curve. The reproducibility is + or - 1/3% The high response accuracy is only guaranteed if the monitor surface retains its metallic polish during the heating. Therefore the monitor was enclosed in a gas-tight sealable capsule of aluminum oxide, quartz, or ferritic steel. Author (NSA)

N71-38082# Army Foreign Science and Technology Center, Charlottesville, Va.
AN INVESTIGATION OF THE STRUCTURE AND PROPERTIES OF EP357 STEEL [ISSLEDOVANIE STRUKTURY I SVOISTV STALI EP357]
O. A. Bannykh et al 4 Nov. 1970 17 p ref Transl. into ENGLISH from the mono. "Struktura i Svoistva Zharprochnykh Metallicheskikh Materialov" USSR, 1967
(AD-727495; FSTC-HT-23-428-70) Avail: NTIS CSCL 11/6

The possibility of employing 45 Kh10G14Yu2 (EP357) steel in certain machine construction areas was investigated, particularly as the construction material for steam superheaters as a substitute for 1Kh1810T and 1Kh18N12T steels. The results of investigations involving a complex of mechanical tests and technological trials, required in order to establish the possibility of utilizing pipes constructed of this material for steam superheaters, are detailed. The mechanical properties of the steel are investigated and the results of x-ray structural analyses are given. The results of the investigation show that further testing of EP357 steel is feasible in order to determine the technological properties of this material. Author (GRA)

N71-38083# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
RELATION OF THE YIELD POINT TO THE FORMATION OF CRACKS DURING PLASTIC DEFORMATION OF STEEL
Yu. Ya. Meshkov 1 Mar. 1971 15 p refs Transl. into ENGLISH from Metallofizika (Kiev), no. 21, 1969 p 16-23
(AD-727233; FTD-HC-23-679-70) Avail: NTIS CSCL 11/6

A study was made of the process of crack formation and its role in yield phenomena during the plastic deformation of steel. Plastic deformation at various stages of its flow can be accompanied by the occurrence of nucleating microcrack with ductile metals. This process occurs more easily during the secondary activated dislocation pile-up than in the primary pile-up. Only a comparatively small dislocation pile-up is necessary for the nucleation of viscous cracking by such a mechanism. A relationship between the moment of formation of cracks and YS gives results that do not conflict with experimental data and permits the explanation of certain effects observed during the drawing of steel wire. GRA

N71-38084*# Battelle Memorial Inst., Columbus, Ohio.
THE EFFECT OF COMPOSITION ON THE MECHANISM OF STRESS-CORROSION CRACKING OF TITANIUM ALLOYS IN N2O4, AND AQUEOUS AND HOT-SALT ENVIRONMENTS, PART 2
J. D. Boyd, P. J. Moreland, W. K. Boyd, R. A. Wood, D. N. Williams et al Washington NASA Oct. 1971 78 p refs
(Contract NSR-36-002-909)
(NASA-CR-1846) Avail: NTIS CSCL 11F

Experimental alloys were prepared to assess the effects of alloy composition on susceptibility to stress corrosion cracking in aqueous environments. A detailed metallographic study was made of the morphology of stress corrosion cracks and of the distribution of slip within the crack-tip plastic zone. These results, and others, are used to formulate a phenomenological model for aqueous stress corrosion cracking of titanium alloys. Crack velocity data are analyzed in terms of an analytic relationship

between crack velocity and applied stress intensity. The stress corrosion cracking behavior in oxygenated N2O4 of a series of experimental alloys containing 5-7 weight percent aluminum was investigated by means of chemical, electro-chemical and fractographic studies. All of the experimental alloys were susceptible in oxygenated N2O4 at 250 psig O2 and 106 F. Alloy composition was found to influence the corrosion resistance and the stress corrosion fracture mode. Author

N71-38085# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
WEAR RESISTANCE OF ELECTROLYTIC IRON-PHOSPHORUS ALLOY
L. I. Kadaner et al 15 Jan. 1971 10 p refs Transl. into ENGLISH from Tekhnol. Organ. Proizvod. (USSR), No. 6 1969 p 66-68
(AD-727441; FTD-HT-23-824-70) Avail: NTIS CSCL 11/6

The results of investigation on the wear resistance of the iron-phosphorus alloys are presented. The investigation aimed to determine the feasibility of utilizing such alloys as the coatings for machine parts to improve their wear resistance.
Author (GRA)

N71-38086# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
A STUDY ON THE EFFECT OF ELECTROMAGNETIC MIXING ON THE CRYSTALLIZATION PROCESS OF DEFORMABLE MAGNESIUM ALLOYS
V. I. Bondarev et al 18 May 1971 17 p refs Transl. into ENGLISH from Sb. Tr. Donetsk. Nauch. Issled. Inst. Chern. Met. (Moscow), 1965 p 83-90
(AD-727177; FTD-MT-24-56-71) Avail: NTIS CSCL 11/6

The effect of electromagnetic stirring (ES) on the ingot solidification of MA8 and MA2-1 Mg-alloys was studied during continuous casting. With increase of stirring intensity the grain size of the ingots became refined, which was caused by the leveling and lowering of the melt temperature next to the solidification front. ES contributes to the macroscopic growth of crystals of manganese phase. With increase of ES intensity the amount of large crystals of magenese phase increased. The refinement of a grain due to ES made it possible to raise the strength and plasticity of the ingots. In ingots of MA8 alloy, ES also made it possible to completely eliminate the anisotropy in mechanical properties. One of the significant results of ES was the increase of plasticity during processing of the ingots of the Mg-alloys, as a result of which crack formation was alleviated in rolling and forging. Author (GRA)

N71-38087# Army Weapons Command, Rock Island, Ill. Research Development and Engineering Directorate.
PROPERTIES OF PREALLOYED STEEL POWDER METALLURGY PRODUCTS Interim Technical Report
Richard E. Westerman May 1971 77 p refs
(AD-727660; AMSWE-RE-71-22) Avail: NTIS CSCL 11/6

The applicability of conventional powder metallurgy fabrication procedures to prealloyed steel powders was investigated. Fifteen lots of steel powder, representing six different major alloy types (4130, 1040, 8620, 4650, 8650, and 9480), have been formed into test bars by conventional fabrication procedures. The three procedures employed are die press, isostatic press, and high-energy rate forming (HERF). The die press and the isostatic press procedures were followed by repress and forge operations. Samples were heat-treated, with a final 900 F temper usually employed. Samples produced by forging and HERF processing, the two methods capable of producing densities close to theoretical densities, have tensile strengths equal to those of wrought material, though ductilities and impact strengths are inferior. Data compilations containing density, hardness, yield strength, ultimate tensile strength, and Charpy V-notch impact energy as functions of fabrication sequence are presented. Author (GRA)

N71-38088# Cornell Univ., Ithaca, N.Y. Dept. of Materials Science and Engineering.
THE FORMATION OF THE OMEGA PHASE IN Ti-Nb ALLOYS
Arthur T. Balcarzak and Stephen L. Sass 30 Jun. 1971 21 p refs
(Contract N00014-67-A-0077-0012)
(AD-727598; Rept-1584; TR-4) Avail: NTIS CSCL 11/6

The as-quenched and the aged form of the omega phase in Ti-Nb alloys was examined using high resolution dark field electron microscopy and diffraction. The as-quenched omega morphology was shown to be based upon <111> rows of equiaxed particles which are 12-20 A in diameter and spaced 20-22 A apart. After short aging times the <111> row length increased, and eventually the isolated rows were replaced by clusters of rows. With continued aging the clusters increased in size and evolved into an ellipsoidal shape. The as-quenched Ti-18 at. pct. Nb alloy exhibited sharp omega reflections and <111> planes of diffuse intensity in reciprocal space As the Nb content of the alloy increased the omega reflections broadened, and in alloys containing 34 at. pct. Nb or more, the <0001> and 0002 omega reflections were shifted toward each other along an (0001) direction. The forbidden (10(-1)0) and (20(-2)0) omega reflections were shown to be real in aged alloys, indicating that the aged form of the omega phase is ordered.
Author (GRA)

N71-38089# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
BRITTLENESS OF STEEL, ITS CONNECTION WITH LOW-CYCLE FATIGUE, AND A CALCULATION PROVIDING WARNING OF BRITTLE FAILURE
V. A. Bykov et al 5 Feb. 1971 10 p refs Transl. into ENGLISH from Termoprochnost Mater. Konstr. Elem., Akad. Nauk Ukr. SSR, Inst. Probl. Materialoved. (Kiev), no. 5, 1969 p 197-200
(AD-727422; FTD-HT-23-38-71) Avail: NTIS CSCL 11/6

The article deals with brittle failure of ship-hard steel. It is concluded that low-cycle fatigue damage does not have an essential influence on the resistance of the investigated steel to plastic deformation, but does noticeably reduce resistance to brittle failure. Brittle failure is predetermined by an unfavorable form of the stressed state and also by operating conditions which have a negative influence on the totality of values of the steel strength during brittle failure and plastic deformation. In calculations providing forewarning of brittle failure it is advisable to compile dimensionless values of the stress parameter and rheological characteristics of the steel independently of the magnitude of external forces. GRA

N71-38090# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PHYSICOCHEMICAL THEORY OF HEAT RESISTANCE AND NEW HEAT-RESISTANT TITANIUM ALLOYS
I. I. Kornilov et al 26 Feb. 1971 18 p refs Transl. into ENGLISH of the publ. "Fiziko-Khimicheskiye Issledovaniya Zharoprochnykh Splavov" Moscow, Nauka, 1968 p 57-64
(AD-727424; FTD-HC-23-668-70) Avail: NTIS CSCL 11/6

An increase in the heat-resistance of titanium is explained by the formation of solid solutions and compounds with a varying degree of dispersity and chemical bond strength, i.e. a solution and dispersion mechanism for the hardening of liter - and beta - solid solutions and the formation of strong titanium compounds. Of particular importance for the heat-resistance of titanium systems are titanium compounds which are formed in them during crystallization, as well as from solid solutions, for example in Ti-Al, Ti-Cu, Ti-Si, Ti-Sn systems and many others. The regularities established for changes in heat resistance according to the composition and structure of binary and ternary titanium systems were used to investigate the heat resistance of more complex titanium systems and to establish the optimum compositions of new heat-resisting titanium systems. These investigations resulted in the development of compositions for new heat-resisting alloys of the ST series with operating temperatures above 600 degrees. GRA

N71-38091# United Aircraft Corp., East Hartford, Conn.
THE CREEP AND SOLIDIFICATION BEHAVIOR OF Al-Al3Ni EUTECTIC WHISKER COMPOSITES Final Report, Mar. 1970 - May 1971
Edward M. Breinan and Earl R. Thompson 30 Jun. 1971 48 p refs
(Contract N00014-67-C-0478)
(AD-727815; K910582-10) Avail: NTIS CSCL 11/4

The strength of the Al-Al3Ni eutectic was shown to be increased by increasing the solidification rate, which has the effect of decreasing the whisker size and interwhisker spacing. In transverse compressive yield strength measurements at room temperature, the dependance of the yield strength on the solidification rate was indicative of the presence of a dispersion strengthening effect of the whiskers on the matrix. The longitudinal compressive yield strengths also increased with decreasing interwhisker spacing. Creep resistance was greatly enhanced with increasing solidification rate, with lower steady state creep rates and longer times to rupture being found in high solidification rate ingots, even when tested at higher temperatures. Scanning electron microscopy was used to reveal whisker morphology in three dimensions in regions where the matrix was etched back from the whiskers. Whisker branching was observed in the solidification direction. The observed branching fits with predictions and explains the changes in whisker concentration observed in the eutectic exhibiting the dual-orientation microstructure. The abrupt changes in whisker direction from axially oriented to misoriented in dually-oriented eutectic and back again was clearly observed. Author (GRA)

N71-38092# Physics International Co., San Leandro, Calif.
DYNAMIC FRACTURE EXPERIMENTS USING HIGH ENERGY PULSED ELECTRON BEAMS Final Report
Tibor Stefansky and James H. Shea Jul. 1971 175 p refs
(Contract DASA01-68-C-0138)
(AD-727983; PIFR-108; DASA-2699) Avail: NTIS CSCL 11/6

The report describes the results of an experimental effort in which high-energy pulsed electron beams were used to study dynamic fracture induced by rapid in-depth heating. The work was performed under the metals portion of the PREDIX program; the materials studied were 6061-T6 aluminum, alpha titanium and OFHC copper. Spallation thresholds for these materials are presented in terms of the absorbed energy required to cause a specified amount of damage as a function of the tensile pulse duration. Differences in the loading paths resulting from plate impact on the one hand and rapid in-depth heating on the other hand are also described. Author (GRA)

N71-38093# Franklin Inst., Philadelphia, Pa.
DEVELOP METAL ALLOYS OF ULTRA FINE GRAIN SIZE WITH IMPROVED MECHANICAL PROPERTIES Final Report
Robin L. Jones Mar. 1971 67 p refs
(Contract N00019-70-C-0206)
(AD-727746; FIRL-F-C2739) Avail: NTIS CSCL 11/6

Unalloyed titanium wire and sheet samples, strengthened by the combined effects of interstitial content, grain refinement to approximately 0.5 microns and cold work have been subjected to a range of evaluation tests, in order to assess the extent to which the two-fold increase in room temperature strength attainable by submicron grain refinement and cold work is accompanied by changes in other mechanical properties. It is shown that the tensile strength is enhanced to roughly the same extent over the temperature range 77 - 550 K but that the enhancement is lost at higher testing temperatures. Exposure to a temperature of 673 K also slowly degrades subsequent room temperature properties with about 1/2 the strength enhancement lost after 200 hours exposure. Improvements in fatigue properties (particularly high stress/low cycle fatigue) and increased resistance to stress corrosion cracking in an aggressive methanolic environment are found to accompany the strength enhancement. An increase in notch sensitivity (in comparison to conventional grain size unalloyed titanium) observed for the strengthened materials is not considered important since these materials continue to exhibit notch strength ratios of ~ 1 for concentration factors up to 5.4. Author (GRA)

N71-38094# Franklin Inst., Philadelphia, Pa. Research Labs.
INVESTIGATION INCLUDING A TESTING PROGRAM TO STUDY AND DEVELOP METHODS FOR IMPROVING DUCTILITY OF BERYLLIUM Final Report
James E. Hanafee Feb. 1971 34 p refs
(Contract N00019-70-C-0262)
(AD-727747; FIRL-F-C2754) Avail: NTIS CSCL 11/6

A new technique for deforming ingot beryllium into sheet form was found. This technique was used to roll beryllium up to 96% at 300 C and roll and upset between 80% to 90% at 200 C without intermediate annealing. The recovery and recrystallization characteristics of the beryllium sheet were determined. It was found that the ingot beryllium rolled 96% began recovery below 400 C while similar beryllium sheet deformed to 85% began recovery in the 500 C region. Both temperatures are well below typical commercial fabrication temperatures and these low temperatures reflected the large amount of stored energy in the beryllium sheet. This resulted in a finer microstructure which in turn resulted in significantly higher mechanical properties, particularly bend ductility. The new fabrication technique was used to make polycrystalline high purity (6 zone pass and 12 zone pass) beryllium sheet. Evidence was found that twinning contributed to the sheet making deformation process in the high purity beryllium sheet. The recovery and recrystallization behavior of this sheet was determined and it appears quite feasible to make fine grain high purity ingot beryllium sheet. Author (GRA)

N71-38095# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EFFECT OF PRELIMINARY DEFORMATION ON CREEP CHARACTERISTICS OF A NIMONIC-TYPE ALLOY
G. Ya. Kozyrskii et al 12 Mar. 1971 12 p refs Transl. into ENGLISH from Metallofiz. Resp. Mezhvedomstvennyi (USSR), no. 23, 1968 p 94-99
(AD-727893; FTD-HT-23-18-71) Avail: NTIS CSCL 11/6

The work presents results of testing for the effect of small degrees of preliminary plastic deformation on creep in Alloy 80, a nimonic type. A complex influence of such deformation was found; it is connected with various physical processes occurring in the case of different degrees of preliminary deformation. Author (GRA)

N71-38096# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
VIBRATION STRENGTH OF CERTAIN STEELS AND OF TITANIUM- AND ALUMINUM-BASED ALLOYS AT HIGH TEMPERATURES
G. S. Krivonogov 12 Mar. 1971 14 p refs Transl. into ENGLISH from Termoprochnost Materialov i Konstruktivnykh Elementov Sbornik (USSR), no. 5, 1969 p 176-183
(AD-727951; FTD-HT-23-99-71) Avail: NTIS CSCL 11/6

The work gives the results of investigating the damping properties of a number of materials either in use or very promising in the field of compressor blade manufacture, an analysis of their vibration strength is also given. As is known, the principal cause of destruction of compressor blades can be found in dynamic stresses. The risk from dynamic stresses is increased sharply owing to the high probability of corrosion-erosion damage during operation. Author (GRA)

N71-38097# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PLASTIC DEFORMATION OF SHEET METALS WITH HIGH DEFORMATION RATES
B. A. Shcheglov 21 May 1971 21 p refs Transl. into ENGLISH from Kuznechno-Shtampovochnoe Proizvod. (USSR), v. 11, no. 2, 1969 p 17-21

(AD-727203; FTD-MT-24-42-71) Avail: NTIS CSCL 13/8

The rate of deformation affects not only the mechanical properties of metals and the ratio between stresses and strains but also the propagation of stress and strain waves in the metal. Depending on the conditions of high energy rate forming under which the load is applied, longitudinal (tensile) or transverse (bending) waves may propagate in the metal. During its plastic deformation sheet metal is deformed in conditions of plane-stressed state and may be regarded as a flexible membrane, while strip can then be regarded as a thread. Interference between the shock waves may result in discontinuities in the metal and hence also in defective products (creasing, bulging).
Author (GRA)

N71-38096# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

SOME PROBLEMS OF THE DEFORMATION AND DESTRUCTION OF HEAT-RESISTANT MATERIALS UNDER THERMOCYCLIC LOADINGS IN CONDITIONS OF SIGN-VARIABLE CREEP

N. S. Mozharovskii et al 5 Mar. 1971 11 p refs Transl. into ENGLISH from Termoprochn. Mater. Konstr. Elem. (USSR), no. 5, 1969 p 124-129
(AD-727945; FTD-HT-23-97-71) Avail: NTIS CSCL 11/6

An analytical description is made of the dependence between deformation, stresses and irreversible absorbing energy during a cycle of thermal fatigue tests of cyclic hardening, cyclic softening and cyclic stable heat resistant alloys. It is shown that the total irreversibly absorbing energy, which leads to failure of material, cannot be accepted as a criterion of thermal fatigue failure.
Author (GRA)

N71-38099# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE PROSPECTS OF METAL RESEARCH DEVELOPMENT

I. M. Savitskii 6 Apr. 1971 46 p refs Transl. into ENGLISH from Akademiya Nauk (SSSR), p 49-71
(AD-727920; FTD-HC-23-59-71) Avail: NTIS CSCL 11/6

The article examined the topic, the method, the current state, and the prospects of developing metal research, especially its theoretical branch. The main questions in the article are the following: the role of metal in science and technology; the state and prospects of developing a theory of metal alloys; the production and investigation of the structure and discovery of new properties of the most frequent monocrystalline metals and alloys; control of the structure and properties of metals and alloys by external extremal effects (high and low temperatures and pressure, electromagnetic fields, etc.); metal compounds and polymorphus metals as a reserve of new metal materials; the problems of a more rational utilization and processing of raw materials, mainly the rare and noble metals, their effectiveness in the national economy; the prospects of a more complete utilization of mechanical and technological properties of metals, alloys, and composite materials, and the problem of thermal sense of brittleness of metals and alloys. The increasing role of metal materials with special electrophysical properties, superconducting metals and alloys, their influence on technical progress, and the questions of biochemical, medicinal and agricultural metal research are also discussed.
Author (GRA)

N71-38100# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

CREEP LIMIT AND STRUCTURAL STABILITY OF THE PARENT METAL AND WELD JOINT MADE FROM IMPROVED LOW-ALLOY HEAT-RESISTING STEEL 12MKh AND 12 Kh1MF

E. M. Kuzmak et al 8 Jun. 1971 16 p refs Transl. into ENGLISH from Inst. Neftekhim. Gazovoy Prom., Tr. Svarivayemost Term. Uprochnennykh Staley (Moscow), no. 70, 1967 p 84-90
(AD-727872; FTD-MT-24-130-71) Avail: NTIS CSCL 13/8

The steels 12MKh and 12Kh1MF are widely used to fabricate equipment and pipe operating at temperatures of up to 540 and 580 degrees centigrade, respectively. Preliminary tests of these steels established that the optimal regime of improving their qualities and welding (such as would assure a welded joint of the same strength as the base metal at normal and elevated temperatures during short-time tests) is as follows: for 12MKh steel; water quenching from 930 degrees centigrade; tempering at 680 degrees centigrade for 2 hr; running energy of welding 2500-4500 cal/cm; for 12Kh1MF steel, water quenching from 980 degrees centigrade tempering at 750 degrees centigrade for 3 hr; running energy of welding 4000-6000 cal/cm. 12MKh steel is best posthested at 630 degrees centigrade and 12Kh1MF steel, at 700 degrees centigrade. The high temperature strength of these steels and of their welded joints, as determined by tensile stress-rupture tests was found to be greater for the steels in improved state. However, in time the effect produced by this improvement gradually diminishes and on extrapolation to 100,000 hr of normal operation this effect completely disappears. On the other hand, if the steels are tested at approximately 520 degrees centigrade this beneficial effect of heat treatment persists.
Author (GRA)

N71-38101# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

PHASE ANALYSIS OF NICKEL ALLOYS

R. B. Golubtsova 4 Jan. 1971 311 p refs Transl. into ENGLISH of the book "Fazovyi Analiz Nikelevykh Splavov" Moscow, Izd-vo Nauka, 1969 p 1-232
(AD-727861; FTD-MT-24-261-70) Avail: NTIS CSCL 11/6

The monograph is the first systematic account of methods of phase analysis of nickel alloys and a literary survey of this question. It gives the results of long-standing investigations of the author and also the work of other researchers. Detailed descriptions are given of the conditions for selection of electrolytes for the anodic dissolution of alloys, caused by the nature of their electrochemical behavior, and also by the solubility of phases and solid solutions in different chemical media. A great deal of attention is given for the first time to the selective electrolytic separation of metallide phases which exist jointly in nickel alloys, with the subsequent determination of their accurate quantitative composition on the basis of microchemical analysis of anodic deposits. Selective electrolytic separation of phases comprises the main assignment of contemporary phase analysis.
Author (GRA)

N71-38102# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

RESISTANCE OF STEEL 40 AND BRASS L62 TO DEFORMATION AT ELEVATED TEMPERATURES

V. P. Severdenko et al 5 Mar. 1971 10 p refs Transl. into ENGLISH from the publ. "Plasticheskaya Deformatsiya i Obrabotka Metallov Davleniyem" Minsk, 1969 p 67-71
(AD-727841; FTD-HT-23-96-71) Avail: NTIS CSCL 11/6

Experimental data are cited concerning the effect of the temperature upon deformation resistance in compression and elongation tests of steel 40 and brass L62. The deformation of steel 40 at 500 degrees and that of brass L62 at 300 degrees decreases by a factor of 1.5-2. The indicated temperatures have been adopted as the temperatures for the warm pressing of the metals under investigation.
Author (GRA)

N71-38103*# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

FATIGUE LIMIT OF ALLOY EI437B DURING PROGRAMMED LOADING AND ELEVATED TEMPERATURE

V. P. Kogaev et al 5 Mar. 1971 11 p refs Transl. into ENGLISH from Termoprochnost Mater. Konstr. Elem. Akad. Nauk Ukr. SSR, Inst. Probl. Materialoved. (Kiev), no. 5, 1969 p 148-152
(AD-727843; FTD-HT-23-98-71) Avail: NTIS CSCL 11/6

Data of fatigue tests conducted on the alloy EI437B under planar bending on an electrodynamic resonance device with programmed loading at 700 and 800 degrees are presented. The results of experiments are statistically processed. The effect of load type on the total of relative lives is clarified. A formula is

proposed for the estimate of the average life under programmed testing. GRA

N71-38104*# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PROTECTION OF METALS FROM CORROSION BY INHIBITORS
T. Neznamova et al 16 Jun. 1971 9 p Transl. into ENGLISH from Budivelni Materialy i Konstruktsii (Kiev), no. 5, 1969 p 11-12
(AD-727853; FTD-HC-23-263-71) Avail: NTIS CSCL 13/8

The action as inhibitors of metal corrosion of compounds of the azole type containing a benzene ring was studied. All of these compounds reacted with the metals, forming a film on their surface. None of the compounds studied was an effective inhibitor of steel corrosion, but their solutions did protect Cu and Al. Benzotriazole inhibited completely the corrosion of Cu and Al at 0.0001 and 0.01 percent, respectively. Benzothiazole inhibited the corrosion of Cu and Al in a concentration of 0.01 percent and benzoxazole in a concentration of 0.01 and 0.1 percent, respectively. While benzimidazole protected Cu in a concentration of 0.0001-001 percent. A solution containing this substance in an amount is smaller than or equal to 1 percent was required to prevent the corrosion of Al. The corrosion of silumin and of the alloys Amg and Amts was prevented by benzotriazole and benzothiazole in the same concentrations as those which protected Al. The protective films were stable and were retained on the surface of metals for a long time after removal of samples from the inhibitor solutions. Among compounds of this class, only benzimidazole and benzotriazole are alkali solution. The inhibitor action of benzimidazole changed little with the pH.
Author (GRA)

N71-38105*# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THEORY OF COMPACTING OF METAL POWDERS
G. M. Zhdanovich 29 Jun. 1971 286 p refs Transl. into ENGLISH of the publ. "Teoriya Pressovaniya Metallicheskikh Poroshkov" USSR, 1969 p 1-262
(AD-727851; FTD-HC-23-775-70) Avail: NTIS CSCL 13/8

The book presents the results of theoretical and experimental studies of the deformation mechanism of compacting powdered bodies, the pressure values of the powerful contact interaction of particles in the compacting process, the distribution of pressure and density in compacts with unilateral and bilateral methods of compacting, the compacting pressure values for metal powders and their mixtures for ideal and real processes, and the elastic properties of compacts. The results of investigating the process of compacting metal powders at high loading rates are also given. GRA

N71-38106# Westinghouse Electric Corp., Pittsburgh, Pa. Astronuclear Lab.
MODIFICATION AND CONTROL OF OXIDE STRUCTURES ON METALS AND ALLOYS Final Report, 20 Nov. 1969 - 20 Nov. 1970
Robert C. Svedberg Apr. 1971 87 p refs
(Contract N00019-70-C-0148)
(AD-728028; WANL-PR(XXX)-001) Avail: NTIS CSCL 11/6

The feasibility of modifying oxide defect structures to enhance oxidation protection of elevated temperature structural materials was investigated. High-pressure, high-temperature techniques and pre-oxidation treatments were used to modify the oxide structure. Nb_2O_5 when subjected to high pressures (78 kbar) and high temperatures transformed to a denser structure with a density increase of about 28%. Nb, Ta, and the niobium alloy, B-1 (Nb-15Ti-10Ta-10W-2Hf-2.5Al) were pretreated in an autoclave containing Fe(3+) ions and a mixed oxide, rutile type tapiolite structure was formed. These films decreased the initial oxidation rate of pure niobium in 20 torr oxygen at 650C. However, the films caused an increased oxidation rate for pure niobium and tantalum in air at 1050C when compared to the untreated metals. The oxidation behavior of the B-1 niobium alloy at 1050C in air was enhanced by a 3-4 hour pre-exposure in 20 torr oxygen at 650C. Metallographic and X-ray analyses indicated that less TiO_2 was formed in the oxide film grown on these samples. In addition, many techniques reported in the literature for altering the oxidation behavior of various metal and alloy systems were reviewed. Author (GRA)

N71-38107# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CALCULATING FATIGUE STRENGTH OF STEELS UNDER BIAXIAL TENSION
Yu. L. Kozhevnikov et al 23 Apr. 1971 14 p refs Transl. into ENGLISH from Tr. Kazansk. Aviats. Inst. (Kazan), no. 105, 1969 p 59-67
(AD-727894; FTD-HT-23-19-71) Avail: NTIS CSCL 11/6

Calculation of the influence of biaxial tension on the fatigue strength of steels on the basis of the basic fatigue strength relations for a complex stress-strain state is given. A comparison of the experimental results with experimental fatigue data obtained for tubular samples of 1Kh18N9T and 30KhGSA steel shows that the Birger-Balashov condition provides the best correlation. This condition is also recommended for calculating structures operating under pressure in the presence of vibrations.
Author (GRA)

N71-38108# Air Force Systems Command, Wright-Patterson AFB, Ohio.
RADIATION DAMAGE AND THERMAL ANNEALING OF DEFECTS IN MOLYBDENUM AND TUNGSTEN
A. N. Ivanov et al 5 Mar. 1971 20 p refs Transl. into ENGLISH from Proc. of Symp. on Radiation Damage in Reactor Mater. held by IAEA in Vienna, 2-6 Jun. 1969, v. 1 p 280-301
(AD-727895; FTD-HT-23-22-71) Avail: NTIS CSCL 11/6

Radiation damage to high temperature metal homologues of molybdenum and tungsten as a function of dose and the reactor irradiation temperature is investigated. The studies were conducted with polycrystalline specimens 99.9 percent pure in the case of molybdenum and 99.85 percent in the case of tungsten. Variation of the specific electric resistance was used as a measure of the radiation damage. The saturation effect of the radiation damage and the differences observed between the behavior of molybdenum and tungsten are discussed from the standpoint of the thermal stability of the radiation defects formed in them. The part played by radiation alloying when tungsten is irradiated with large thermal neutron doses is also discussed. A study is made of the thermal annealing of radiation defects in molybdenum and tungsten subjected to various irradiation doses at temperatures above room temperature. The similarity between the three recovery stages in the increase in specific electric resistance, observed during annealing in these metals, and the nature of the defects responsible for the recovery stages are discussed. The variation in fine crystal structure for molybdenum and tungsten during reactor irradiation and subsequent annealing is investigated. Author (GRA)

N71-38109# Air Force Systems Command, Wright-Patterson AFB, Ohio.
PRESENT STATE OF PROBLEM OF WELDABILITY OF HEAT HARDENED STEELS
E. M. Kuzmak 14 Jun. 1971 13 p refs Transl. into ENGLISH from Tr. Inst. Neftekhim. i Gaz. Prom. (Moscow), no. 70, 1967 p 5-9
(AD-727904; FTD-HT-23-323-71) Avail: NTIS CSCL 11/6

The author discusses the problem of structural transformations (particularly mechanical) in the thermal influence zone of heat-hardened steels. Softening characteristics of low-alloy steels are given along with methods for regulating softening during welding. GRA

N71-38110# Air Force Systems Command, Wright-Patterson AFB, Ohio.
TESTS OF HIGH-STRENGTH SHEET STEEL FOR EVALUAT-

ING ITS RESISTIVITY TO THE FORMATION OF COLD CRACKS DURING WELDING UNDER CONDITIONS OF BIAXIAL STRESSED STATE
E. L. Makarov et al 29 Jun. 1971 12 p refs Transl. into ENGLISH from Tr. Mosk. Vysshee Tekhn. Uchilischche (Moscow), no. 133, 1969 p 87-91
(AD-727909; FTD-MT-24-55-71) Avail: NTIS CSCL 13/5

A new method of testing high-strength sheet steel to determine its resistivity to cold crack formation in welding is examined. Descriptions are given of the loading device and testing technology. GRA

N71-38111*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PRELIMINARY STUDIES OF METALLIC BONDING BETWEEN LIQUID MERCURY AND TRACE CONTAMINANTS USING A NEW SAMPLING TECHNIQUE
Ronald Rezner Washington Nov. 1971 47 p refs
(NASA-TM-X-2424; E-6473) Avail: NTIS CSCL 11F

A technique of microsampling a metal surface at a single point that combines principles of electrostatics, electrochemistry, ion exchange and emission spectrographic analysis is described. The method can be used to perform chemical analysis or to provide information about the nature of metallic bonding and kinetic processes at electrode surfaces. It was used to study trace element contamination in liquid mercury. Results indicate the formation of compounds with mercury whose properties change with time and whose composition may be influenced both by the method used to add the contaminant and by the presence of contamination other than that being studied. Author

N71-38112# Grumman Aerospace Corp., Bethpage, N.Y. Materials and Structural Mechanics Section.
INFLUENCE OF MICROSTRUCTURE ON THE MECHANICAL PROPERTIES AND STRESS CORROSION SUSCEPTIBILTY OF 7075 ALUMINUM ALLOY
P. Adler, R. De Iasi, and G. Geschwind Nov. 1971 51 p refs
(RM-522) Avail: NTIS

Matrix and grain boundary features were systematically varied, using appropriate heat treatment, to evaluate their significance in changing the mechanical and stress corrosion properties of aluminum alloy. Maximum strength is associated with a Guinier-Preston zone matrix. The precipitate-free zone adjacent to high angle grain boundaries was found to have only a slight effect on yield and tensile strength and a greater influence on hardness. Stress corrosion susceptibility was studied in a chloride ion environment over a 0.73.5 pH range. Differences in pH-dependent susceptibility associated exclusively with grain boundary structure for material of highest strength were observed. Grain boundary precipitate spacing (inversely related to precipitate density) was found to be of primary importance to susceptibility. The relative importance of crack initiation to the over-all stress corrosion process was also found to be dependent on grain boundary microstructure. These results indicate that improved properties for Al-Mg-Zn-type alloys can be attained by a desirable combination of matrix and grain boundary structure. Author

N71-38113 National Lending Library for Science and Technology, Boston Spa (England).
STUDY OF PRECIPITATION PHENOMENA IN AN Al-Mg-Si ALLOY FOR ELECTRICAL APPLICATION (ALMELEC)
J. Benmarin et al 2 Mar. 1971 30 p refs Transl. into ENGLISH from Mem. Sci. Rev. Met. (France), v. 66, no. 12, 1969 p 895-905
(NLL-M-20371-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 3 NLL photocopy coupons

The structure and the structural hardening mechanism of Almelec, an aluminum alloy containing 0.7 % magnesium, 0.6 % silicon, and 0.25 % iron, were investigated. A description is given of the processes for producing Almelec wire. The different phases of hardening were examined with an electron microscope to determine the composition of the intermetallic compounds which were present. The conditions of structural hardening and the effects of different metal transformation factors on the structure are discussed. Hot rolling, quenching, and age hardening effects are included as well as work hardening effects on the precipitation. J.M.

N71-38114 National Lending Library for Science and Technology, Boston Spa (England).
IONIC CONDUCTIVITY OF MOLYBDENUM TRIOXIDE
Yu. A. Pavlov et al 12 May 1971 7 p refs Trans. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Chem. Met. (Moscow), no. 1, 1971 p 5-8
(NLL-M-21003-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The ionic conductivity of MoO3 without and with addition of 0.5% (mol) of Cu20 was studied by the emf method with a cell having a partitioned gas space. The oxide under investigation served as the solid electrolyte. The proportion of ionic conductivity was determined by comparing the data obtained with thermodynamic data. The overall electrical conductivity was measured by a four probe method. The increase in ionic conductivity when Cu20 is added is explained by the increase in the concentration of anionic vacancies. Results of the investigation of the temperature dependence of ionic conductivity were used to estimate the coefficient of self diffusion of oxygen in MoO3. Author

N71-38115 National Lending Library for Science and Technology, Boston Spa (England).
INFLUENCE OF DIFFUSION DURING HEATING ON THE STRENGTH OF THE BOND BETWEEN BIMETAL LAYERS
V. A. Mesterov et al 12 May 1971 9 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Chem. Met. (Moscow), no. 1, 1971 p 101-105
(NLL-M-21017-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

A model is proposed for explaining the lowering in strength of the bond between bimetal layers after heating. The model is based on the coagulation of excess vacancies in the bond zone. Data on the dependence of the relative strength on temperature and heating were obtained and tested. The results in strength variation using the model were in agreement with those of microfractographic examination. Author

N71-38116 National Lending Library for Science and Technology, Boston Spa (England).
ULTRASONICALLY TESTED STEEL PLATE: TECHNICAL SUPPLY SPECIFICATIONS V. D. EISENHUETTENLEUTE, 072-69, 1ST EDITION DECEMBER 1969
5 Apr. 1971 13 p refs Transl. into ENGLISH of German report
(NLL-CE-Trans-5536-(9022.09)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The ultrasonic inspection of steel plates to determine laminations and inclusions is discussed. The specifications supplement other quality specifications for heavy plate. Topics covered include: (1) classification of plate, (2) requirements to be met by ultrasonically tested plate, (3) testing procedures, and (4) objections. Author

N71-38117 National Lending Library for Science and Technology, Boston Spa (England).
DEPOSITION OF COPPER AT HIGH CURRENT DENSITIES
L. Krushev May 1971 12 p refs Transl. into ENGLISH from Izv. Inst. po Fiziol., Bulgar. Akad. Nauk. (Sofia), no. 6, 1967 p 71-78
(NLL-RTS-5647) Avail: Natl. Lending Library, Boston Spa, Engl.: 4 NLL photocopy coupons or £ 1.10: BIS 94.06

The investigations on the electrochemical deposition of copper at high current densities are used to devise a method for the continuous production of copper foil. Results show that, (1) copper deposits of good quality are obtained at current densities

considerably higher than those used in ordinary conditions. They may be obtained by increasing the degree of agitation, raising the temperature and maintaining high solution concentrations. (2) with an increase in the current density, the quality of the deposit is strongly dependant upon small changes in the variables investigated. Author

N71-38118 National Lending Library for Science and Technology, Boston Spa (England).
EFFECT OF ADDITION OF SOME METALLIC SALTS TO WATT'S TYPE ELECTROLYTE ON DEGREE OF HYDROGENATION OF NICKEL COATINGS
V. Raklyte-Kadziauskiene et al 7 Mar. 1971 12 p refs Transl. into ENGLISH from Liet. TSR Mokslu Akad. Darbai, Ser. B. (Lithuanian SSR), v. 60, no. 1, 1970 p 113-119 In ENGLISH and RUSSIAN
(NLL-Trans-746-740-(9022.401)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The influence of metals sulphates on the hydrogen content in nickel deposits from Watts' type bath was studied. Salt of metals with a higher hydrogen over-voltage was found to increase the content of hydrogen in nickel plates at smaller additions and concentrations. It was shown that some organic brighteners of the first class (saccharin and benzene sulphonamide) decrease the content of hydrogen in nickel films obtained in bath containing FeSO4 or CdSO4. Author

N71-38119 Pennsylvania State Univ., University Park.
A NON-LOCAL PSEUDOPOTENTIAL CALCULATION OF CONTRIBUTIONS TO THE KNIGHT SHIFT IN BERYLLIUM METAL
Joseph Gerstner (Ph.D. Thesis) 1969 77 p
Avail: Univ. Microfilms Order No. 70-19413

The hyperfine contact and the diamagnetic contributions were calculated and, to compute the complete Knight shift, the results were combined with core polarization effects. Wave functions and the effective mass on the Fermi surface were obtained by a non-local pseudopotential calculation using an OPW potential. Energies and wave functions were determined for 712 points in the 1/24th Brillouin zone, from which 190 points were obtained by interpolation on the Fermi surface chosen 0.95 ryd above the gamma point energy. First and second derivatives of the energy function were also obtained at these points by interpolation. From these 190 points on the 1/24th portion of the Fermi surface, averages of the Knight shift due to hyperfine contact interaction and to diamagnetic susceptibility were obtained. The effect was shown to be primarily the result of orbital contributions (diamagnetism), with the hyperfine interaction contributing less than originally predicted. Dissert. Abstr.

N71-38120 Stanford Univ., Calif.
THE EFFECT OF TEMPERATURE AND FIBER ORIENTATION ON THE STRENGTH AND DEFORMATION CHARACTERISTICS OF FIBER COMPOSITES
Fathi Aref Ibrahim Darwish (Ph.D. Thesis) 1970 196 p
Avail: Univ. Microfilms Order No. 70-18394

The tensile behavior of the composite in both the longitudinal (parallel to fiber axis) and transverse (perpendicular to fiber axis) direction was evaluated in the temperature range -196 C to 200 C. It was found that a drop in temperature from 200 C down to -196 C causes the composite strength to increase by as much as 100%. Although the density of cracked fibers, when the composite is loaded parallel to fiber axis, is shown to increase under increasingly applied stress, premature fiber failure does not lead to instability and the composite strength is primarily determined by the average fiber strength. Taking plasticity of the matrix into account by linearizing its stress-strain curve, the longitudinal strength of the composite was predicted from the individual properties of its components. Dislocation etch-pitting studies of deformed Charpy-5 specimens have revealed that the fiber orientation with respect to the specimen axis has a marked effect on the distribution of plastic deformation in the vicinity of the notch. Dissert. Abstr.

18 MATERIALS, NONMETALLIC

Includes corrosion; physical and mechanical properties of materials (e.g., plastics); and elastomers, hydraulic fluids, etc. For basic research see: 06 Chemistry. For related information see also: 17 Materials, Metallic; 27 Propellants; and 32 Structural Mechanics.

N71-38121# Bhabha Atomic Research Centre, Bombay (India).
DC ARC METHOD FOR THE DETERMINATION OF RARE EARTH IMPURITIES IN YTTRIUM OXIDE
S. V. Grampurohit, R. C. Naik, and Kum S. B. Sindgikar 1971 9 p refs
(BARC-521) Avail: AEC Depository Libraries

A dc arc method was worked out for the estimation of the impurities Gd, Tb, Dy, Ho, and Er in yttrium oxide. Yttrium oxide is mixed with graphite in the ratio 1 : 1 and 10 mg of this mixture is used as charge in a dc arc running at 8 amps. The spectra are recorded on a grating spectrography with a 30,000 lines/inch grating blazed at 3300 A in the first order at a linear dispersion of 2.5 A/mm. Working curves are obtained with synthetic standards. A weak yttrium line is chosen as an internal standard. The method achieves a sensitivity ranging from 20 to 50 ppM and the average standard deviation for different elements varies from 10 to 20%. Author (NSA)

N71-38122# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
CHARACTERISTICS OF VARIOUS SEALING MEMBRANES FOR ALPHA ACTIVITY MONITORING CELLS USED IN SOLUTIONS
J. C. Edeline and J. Le Devehat 8 Jan. 1971 44 p refs In FRENCH
(CEA-N-1440) Avail: AEC Depository Libraries

The membranes used in on line alpha activity measurement cells must possess the following characteristics: mechanical strength, transparency to alpha particles, resistance against chemical attack and contamination, and ease of decontamination. Various membranes were studied: polyamide, polyethylene, ethylene .polyterephtalate, polytetrafluorethylene, and polypropylene. Only the polypropylene gave satisfactory results with nitric solutions. None of the membranes was entirely satisfactory against organic solvents. NSA

N71-38123*# Los Alamos Scientific Lab., N.Mex.
CMB-13 RESEARCH ON CARBON AND GRAPHITE
Progress Report, 1 Feb. - 30 Apr. 1971
Morton C. Smith Sep. 1971 28 p Sponsored in part by NASA
(Contract W-7405-eng-36)
(NASA-CR-123171; PR-17; LA-4770-MS) Avail: NTIS CSCL 11D

Continuing research is reported involving a microstructural approach to the study and characterization of natural, commercial, and experimental carbons and graphites. The techniques employed in the research include X-ray diffraction electron and optical microscopy, and porosimetry. Physical and mechanical properties are measured as functions of formulation, treatment, and environmental variables. The categories of materials investigated are treated separately and include: Santa Maria coke, highly oriented polycrystalline graphites, graphite-carbide composites, and raw materials. In addition, individual studies involving mass spectrometry of furfuryl alcohol resin components, and particle packing in particulate composites, are reported. D.L.S.

N71-38124# Union Carbide Corp., Oak Ridge, Tenn. Y-12 Plant.
IMPREGNATION OF POROUS GRAPHITE FOR FLOW MODIFICATION
W. H. Resnick and M. L. Shell 7 Jun. 1971 15 p

(Contract W-7405-eng-26)
(Y-SC-7) Avail: NTIS

A method for measuring the permeability of air-bearing-type graphite pads and a technique for impregnating air-bearing pads in order to achieve a desired permeability have been developed. Studies have been conducted that show results of the impregnation on bearing stability. Author (NSA)

N71-38125# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
FUNDAMENTALS OF DETAILED CALCULATIONS OF REINFORCED PLASTICS, CHAPTER 1
Yu. M. Tarnopolskii et al 7 May 1971 78 p Transl. into ENGLISH from the book "Osobennosti Rascheta Detalei iz Armirovannykh Plastikov" Riga, Izd-vo Zinatne, 1969 p 13-65
(AD-727471; FTD-MT-24-345-70) Avail: NTIS CSCL 11/9

The chapter deals with features of the structures and properties of fiber-reinforced materials. The materials are classified as to structure of the reinforcing fibers and subsequent reference to parts from fiber-reinforced plastics is in terms of the ideal model. Regular and random twisting of the reinforcing fibers, composite materials with small initial irregularities and preliminary twisting of the reinforcement make up the remaining general areas. Author (GRA)

N71-38126# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SPECTRAL DEGREE OF BLACKNESS FOR CERTAIN REFRACTORIES AT HIGH TEMPERATURES
V. V. Yanulis 19 Mar. 1971 12 p refs Transl. into ENGLISH from Tr. Akad. Nauk Lit. SSR (USSR), no. 4, 1967 p 111-115
(AD-727473; FTD-HT-23-252-71) Avail: NTIS CSCL 11/2

Values of spectral degree of blackness are established for given refractories at temperatures lying between 1600-3000 degrees K. It is established that the spectral degree of blackness varies with temperature. Character of the variation strongly depends on the nature of a refractory. Values of spectral degree of blackness depend on composition, structure and surface cleaning of radiating material. The established results are compared with the results of other authors. Author (GRA)

N71-38127# Avco Corp., Wilmington, Mass.
EFFECT OF VOIDS ON MECHANICAL PROPERTIES OF GRAPHITE FIBER COMPOSITES Contract Report, 1 Mar. 1969 - 30 Nov. 1970
Edward M. Lenoe 30 Nov. 1970 55 p refs
(Contract N00019-70-C-0242)
(AD-727236; AVSD-0166-71-RR) Avail: NTIS CSCL 11/4

The results of an investigation of the effect of voids on the mechanical properties of Thornel 50/Epoxy and Modmor II/5208 Epoxy are discussed and presented. Unidirectional, as well as quasi-isotropic, laminates with symmetrical and nonsymmetrical ply-stacking sequences were fabricated with high and low porosity and subsequently subjected to detailed nondestructive and destructive testing. Longitudinal and transverse flexure and tension, short beam shear, and torsion rod experiments were completed on the two composite systems at 75 and 250 F. Ultrasonic compression and shear wave velocities were measured at discrete locations on a specimen-by-specimen basis, and the observations correlated with observed mechanical properties. In addition, an in-depth metallographic characterization of voids was completed on Thornel 50/Epoxy and correlation established for NDT - mechanical properties and voids. These relationships were used to estimate upper and lower bounds on the strength and stiffness envelopes of the unidirectional and angle-ply composites. This permits evaluation of the degradation effects of voids on composite performance. Author (GRA)

N71-38128# Army Foreign Science and Technology Center, Charlottesville, Va.
PRODUCING FIBROUS CARBON MATERIALS ON THE BASIS OF PYROLISIS OF PHOSPHATES OF CELLULOSE [POLUCHENIYE UGOLNYKH VOLOKNISTYKH MATERIALOV NA BAZE PIROLIZA FOSFATA TSELLYULOZY]
N. N. Ermolenko et al 13 Jul. 1971 8 p refs Transl. into ENGLISH from Izv. Akad. Nauk Belorussk. SSR, Ser. Khim. Nauk (Minsk), 20 Oct. 1967
(AD-727141; FSTC-HT-23-924-71) Avail: NTIS CSCL 11/5

The possibility of improving on pyrolitic carbon fibrous products are discussed. Chemical modification of cellulose fibers and the addition of metals improved yield and stability. GRA

N71-38129# Naval Air Development Center, Johnsville, Pa. Aero Mechanics Dept.
VISCOELASTIC CREEP AND RELAXATION IN LAMINATED COMPOSITES Progress Report
Edward J. McQuillen 30 Jun. 1971 36 p refs
(AD-727120; NADC-AM-7115) Avail: NTIS CSCL 11/4

An analytical method is presented to predict the viscoelastic creep and relaxation behavior of filamentary reinforced angle-ply laminates. Methods based upon micromechanics are used to analytically predict the time dependent properties of unidirectional fiber reinforced composite materials. A linear, viscoelastic, orthotropic laminate theory (including thermal effects) is mathematically formulated. A computational method is presented to solve the resulting convolution integral equations. Numerical results for both boron-epoxy and graphite-epoxy laminates at room temperature are presented and compared with limited experimental data. Author (GRA)

N71-38130# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INFLUENCE OF DISPERSION MEDIUM COMPOSITION ON THE PROPERTIES OF LUBRICANTS THICKENED WITH LITHIUM SOAPS OF SYNTHETIC FATTY ACIDS (SFA)
M. S. Gusarova 19 Mar. 1971 7 p Transl. into ENGLISH from Neftepererabotka i Neftekhimiya (USSR), no. 2, 1970 p 43
(AD-727432; FTD-HT-23-136-71) Avail: NTIS CSCL 11/8

The dispersion media were naphthenic aromatic and paraffinic spindle oils, the same oils dearomatized with oleum, and high viscosity naphthenic paraffinic oils, using 9 percent lithium soaps of narrow SFA fractions as thickening agents. A satisfactory grease was obtained with naphthenic paraffinic spindle oil only when the latter was thickened with soap of given fatty acids. The soaps of all acid fractions had low thickening effects in high viscosity oils. Adequate lithium greases were obtained when aromatized oils or distillates were thickened with the narrow fraction of fatty acid which had the optimum thickening effect. Author (GRA)

N71-38131# General Electric Co., Schenectady, N.Y.
GLASS STATIC FATIGUE Final Technical Report, 1 Sep. 1967 - 30 Jun. 1971
Robert H. Doremus Aug. 1971 42 p refs
(Contract N00014-68-C-0126)
(AD-727736; S-71-1068) Avail: NTIS CSCL 11/2

Phase separation in the sodium borosilicate system was studied, as well as reasons for immiscibility in silicate. Models for the alkali ion peak and a higher temperature peak in the internal friction in alkali silicate glasses were developed. Models for static fatigue in glass were discussed, as was the relation of static fatigue to engineering design. Crystals in glass were examined in the electron microscope to study the kinetics and mechanism of crystallization. Author (GRA)

N71-38132# Dow Chemical Co., Midland, Mich.
LATEX MODIFICATION OF FAST-FIX C-1 CEMENT FOR THE RAPID REPAIR OF BOMB-DAMAGED RUNWAYS Report for 16 Apr. 1970 - 12 May 1971
R. Eash and G. M. Hart May 1971 204 p refs
(Contract DACA39-70-C-0032)
(AD-727728; AEWES-TR-C-71-1) Avail: NTIS CSCL 11/3

The report consists, essentially, of two parts: a state-of-the-art review and laboratory testing of the effects of adding two Dow

polymeric latexes to Fast-Fix C-1. The state-of-the-art review covers several basic studies in which many materials, both organic and inorganic, were investigated. The study was then focused on the study of fast-setting inorganic cements and methods to obtain high strength concrete, silicate concrete, and cementitious ceramic materials, are also covered. The state-of-the-art review also has a section indicating areas in which fast-setting cements can serve and the requirements placed on this service. Topics covered are runway design, pavement requirements, pavement evaluation, surface repair, and cold weather construction. In the lab study, two polymeric latexes, Dow Latex 460 and Dow Latex 464, were incorporated at selected concentrations in Fast-Fix C-1 mortars. Tests were conducted to determine freeze-thaw durability, tensile strength, compressive strength, flexural strength, and shear bond. All latex concentrations improved bond strength and freeze-thaw durability and decreased 24-hour water absorption. All concentrations tended to retard set and early strength gain. Low concentrations (4%) of Latex 464 produced a modest improvement in compressive and flexural strengths, but no change in the elastic modulus.
Author (GRA)

N71-38133# Southern Research Inst., Birmingham, Ala.
DEVELOPMENT OF RAIN-EROSION-RESISTANT COATINGS FOR HIGH SPEED AIRCRAFT Final Report, 15 Jan. 1970 - 14 Jan. 1971
A. C. Tanquary, Robert E. Burks, Jr., and M. Virginia Jackson Mar. 1971 41 p refs
(Contract N00019-70-C-0330)
(AD-727750; A-579-2406-6) Avail: NTIS CSCL 11/3

A polymer prepared as a prospective rain-erosion-resistant coating from hexafluoroacetone, propylene, and bis(dimethylamino)-dimethylsilane had a glass-transition temperature of -50C, and it had good resistance to heat and aliphatic or aromatic hydrocarbons. However, it was not successfully cured to an elastomer. A polymer prepared from 1,4-bis(dimethylhydroxysilyl) benzene and bis(dimethylamino)dimethylsilane had a glass-transition temperature of -62C, excellent thermal stability, but less resistance to hydrocarbons than the fluoropolymer. It was cured to a tough elastomer at room temperature. The coating obtained when this elastomer was sprayed onto air-foil test specimens was found to have much greater resistance to simulated rain erosion at ordinary temperatures than a silicone coating and slightly less than neoprene. It suffered no degradation on being heated 4 hours at 250C, as indicated by sand-erosion tests. Author (GRA)

N71-38134# Materials Research Lab., Inc., Glenwood, Ill.
FACTORS CONTROLLING THE STRENGTH OF COMPOSITE STRUCTURES Final Report, 1 Mar. 1970 - 28 Feb. 1971
Sheldon Mostovoy and E. J. Ripling 28 Feb. 1971 86 p refs
(Contract N00019-70-C-0137)
(AD-727600) Avail: NTIS CSCL 13/5

Room temperature fracture toughness, G sub IC, and stress corrosion cracking (SCC) properties of adhesive bonds were studied using aluminum, stainless steel, a titanium alloy, brass and glass adherends with several simple epoxy resins hardened with TEPA, HHPA, MPDA or NMA: the use of A1100 silane finish was found to improve the bonding performance (G sub IC) of all adherends except aluminum. The effect of temperature on G sub IC was measured for the TEPA and HHPA cured DER 332 resin adhesives as well as on one tough commercial system. The behavior of the commercial system was opposite to that seen for the simple systems. Increased cracking rate applied to a normally crosshead-driven adhesive system showed a rate discontinuity at 10 feet/second. Toughness of commercial adhesives using aluminum adherends was between 1.5 and 20 lbs/in. All commercial materials were immune to room temperature SCC when properly bonded using a suitable primer. A superimposed G sub II component was found to raise raised G sub ISCC in a room temperature SCC test. Author (GRA)

N71-38135# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE QUESTION OF THE POSSIBILITY OF STATISTICALLY EVALUATING THE LUBRICATING PROPERTIES OF ELECTROLYTES
S. N. Postnikov et al 2 Feb. 1970 8 p refs Transl. into ENGLISH from Tr. Politekhn. Inst. (Gorkii), v. 24, no. 11, 1968 p 41-43
(AD-727449; FTD-HT-23-46-71) Avail: NTIS CSCL 11/6

A method is described for investigation of friction in the system: metal A-lubricating electrolyte metal B. The emf E(t) between A and B was measured. The relation magnitude of E(g) greater than magnitude of E(t) was assumed to hold, where E(g) is the galvanic cell emf and E(t) the thermal emf. Because the lubricating properties of electrolytes are related to the time E(g) is active, an automatic system consisting of amplifier, pulse generator, and pulse counter was used to measure these time intervals. Four friction pairs A-B were examined: bronze steel 45Kh; brass steel 45Kh; bronze steel 5; brass steel 5. Na succinate and Na adipate were used as electrolytes. Their lubrication properties appeared to be different and to depend on the nature of the friction surfaces. Author (GRA)

N71-38136# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DISTRIBUTION OF MICROHARDNESS OVER THE HEIGHT OF AN ANTIFRICTION SURFACING
A. L. Lugovskoi 29 Jan. 1971 9 p refs Transl. into ENGLISH from Detali Mash. Podemno-Transp. Mash. (Kiev), no. 9, 1969 p 45-48
(AD-727416; FTD-HT-23-886-70) Avail: NTIS CSCL 11/3

Results are presented of investigations of the microhardness of materials, according to height of built-up layers, which are correlated with the degree of mutual penetration at the contacting surfaces. It was established that the microhardness of copper, lead, caprone, and Babbitt layers rises in proportion to nearness to the steel base. In addition, with a high built-up layer the mutual penetration of the two surfaces increases. GRA

N71-38137# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PREPARATION AND STUDY OF THE ANTIOXIDANT INKhP-21 (Ca)
A. M. Kuliev et al 15 Jan. 1971 10 p refs Transl. into ENGLISH from Prisadki k Smazochnym Maslam (USSR), no. 2, 1969 p 8-11
(AD-727413; FTD-HT-23-760-70) Avail: NTIS CSCL 11/8

The antioxidant additive INKhP-21 (calcium) was prepared. Preliminary tests showed adequate effectiveness of the new additive (on the level of the barium variant). In combination with SB-3 the engine properties of INKhP-21 (Ca) are equal in value to those of INKhP-21 (Ba) and the new additive is recommended for expanded testing. Author (GRA)

N71-38138# General Electric Co., Philadelphia, Pa. Space Div.
STABILITY OF OXIDES IN METAL ALLOY MATRICES Technical Report, 15 May 1970 - 15 May 1971
R. L. Mehan and T. A. Harris Wright-Patterson AFB, Ohio AFML Aug. 1971 81 p refs
(Contract F33615-69-C-1635)
(AD-727781; AFML-TR-71-150) Avail: NTIS CSCL 11/4

The objective of the program was to conduct a study of the chemical interaction between Tyco single-crystal sapphire filaments and nickel and nickel alloys, and to determine the effects of these reactions on filament and composite strength. During the first year's work on this contract, the reactions between sapphire and nickel, nickel-chromium, and U-700 were studied in both air and hydrogen, and the effect of these reactions on extracted filament strength was determined. During the present contract period, the emphasis was placed on the effect of filament-matrix reactions on the transverse and longitudinal strength of sapphire-nichrome composites. A determination of the in-situ strength of sapphire filaments in

nichrome revealed that the strength was about that of the as-received filaments. This verifies the conclusion drawn after the chemical reactivity studies performed last year, where the attack by nichrome on sapphire was very much less than that in the case of nickel. Because of this lack of strength degradation during composite fabrication, the NiCr/Al2O3 system seems to possess considerable potential as a composite system. It was found, irrespective of the treatment given to the composites, that the sapphire-matrix bond was weak. Sputtering titanium on the sapphire did not seem to appreciably increase the transverse strength, but only very thin coatings were applied. In actual use, of course, proper composite design such as the judicious use of cross plies could reduce the severity of this problem.
Author (GRA)

N71-38139# Air Force Systems Command, Wright-Patterson AFB, Ohio.
ELECTRON MICROSCOPE AND ROENTGENOGRAPHIC STUDY OF ZIRCONIUM DIOXIDES STABILIZED BY YTTRIUM OXIDE
A. E. Rautbort et al 24 Jun. 1971 18 p refs Transl. into ENGLISH from the publ. "Materialy dlya Kanala MGD-Generatora" Moscow, Izd. Nauka, 1969 p 68-79
(AD-727975; FTD-MT-24-107-71) Avail: NTIS CSCL 11/2

Electron microscope and roentgenographic analyses were used for the study of the structure of technical, chemically pure zirconium dioxide stabilized by yttrium oxide. Changes in its fine and porous structure are indicated during long term, high temperature heating under test stand conditions and operation in an MHD generator channel.
Author (GRA)

N71-38140# Avco Corp., Lowell, Mass. Systems Div.
MICROSTRUCTURE STUDIES OF REFRACTORY POLYCRYSTALLINE OXIDES Summary Report, 1 Apr. 1970 - 1 Feb. 1971
William H. Rhodes and Rowland M. Cannon 1 Feb. 1971 75 p refs
(Contract N00019-70-C-0171)
(AD-727618; AVSD-0192-71-CR) Avail: NTIS CSCL 11/2

The program was concerned with two aspects of this very broad problem: (1) the plastic deformation of fine-grained high purity hot pressed Al2O3 as compared with similarly processed but lower purity material and (2) the stress corrosion of polycrystalline MgO and whether a chemical or mechanical (dislocation) model for failure applies.
Author (GRA)

N71-38141# Naval Ordnance Lab., White Oak, Md. Missile Dynamic Div.
DETERMINATION OF THRESHOLD DAMAGE IN RADOME MATERIALS BY DISCRETE IMPACT IN A BALLISTICS RANGE
J. L. Lankford and R. A. Leverance 30 Jun. 1971 104 p refs
(AD-728030; NOLTR-71-113) Avail: NTIS CSCL 11/2

Techniques for the study of discrete impact with solid and liquid particles on materials specimens have been applied in the NOL Aerophysics Range. The techniques and results for the determination of threshold impact damage of control materials and of a slip cast fused silica are presented. The preliminary results on drop distortion and drop stripping are observed and compared with analytical estimates. Data were obtained for several materials with water droplets of approximately 1 mm diameter. Data were also obtained for limited conditions with .050 in. and .070 in. diameter lead spheres. Velocities from approximately 300 feet per second through 3500 feet per second were obtained, depending upon the material under investigation. The major effort in this program phase was the investigation of slip cast fused silica at a pressure of one atmosphere. Distinct and repeatable damage thresholds were observed with water impact on this material.
Author (GRA)

N71-38142# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
AN INCREASE OF THERMO-OXIDIZING STABILITY OF SYNTHETIC OILS WITH THE AID OF ANTIOXIDANT ADDITIVES
R. I. Kobzova et al 11 Jun. 1971 72 p refs Transl. into ENGLISH from Neftepererab. Neftekhim. Akad. Nauk Ukr. SSR, Respub. Mezhvedom. Sb. (Moscow), no. 4, 1970 p 26-27
(AD-727891; FTD-MT-24-63-71) Avail: NTIS CSCL 11/8

A synthetic oil, MAC-36, had low susceptibility to antioxidant additives. Ferrocene, 16-3, and other such additives containing metals reduced the stability of the oil. The additives increased greater than 2- and 3-fold at 200 and 150 degrees, respectively, the stability of an ester of pentaerythritol as a dispersion medium for greases. The most efficient additives were phenyl-alpha-naphthylamine, disalicylalethylenediamine, and dilauryl selenide.
Author (GRA)

N71-38143# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DETERMINATION OF RESIDUAL STRESSES IN COMPOSITION MATERIALS
V. P. Severdenko et al 16 Feb. 1971 13 p refs Transl. into ENGLISH from Akad. Nauk Belorus. SSR, Ser. Fiz.-Tekhn. Navuk (USSR), no. 4, 1969 p 77-81
(AD-727206; FTD-HC-23-853-70) Avail: NTIS CSCL 11/4

The considerable differences that exist between the mechanical and physical properties of the components in composition materials invariably result in the appearance of longitudinal and transverse residual stresses in the manufacture and usage of fibre-reinforced materials. In this study, an attempt is made to develop empirical methods for the determination of longitudinal residual stresses in materials, reinforced by continuous fibers, when their deformation history is unknown. These methods are based on the characteristics of the expansion and compression diagrams of composition materials. Experiments were performed on the following systems: aluminum - steel, aluminium - tungsten, and nickel tungsten with different volumetric content of reinforcing wires. A universal :Shopper: machine was used for the testing. The rate of the gripping movement was 0.5 mm/min. Specimen deformation was determined by a strain gauge with a 0.005 mm scale value and a 50 mm base.
Author (GRA)

N71-38144# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
STRENGTH AND PLASTICITY OF ZIRCONIUM CARBIDE
A. G. Lanin et al 12 Mar. 1971 13 p refs Transl. into ENGLISH from Termoproch. Mater. Konstr. Elem. (USSR), no. 5, 1969 p 306-312
(AD-727942; FTD-HT-23-95-71) Avail: NTIS CSCL 11/2

The bending and tensile strength and plasticity of ZrC samples sintered in the atmosphere of Ar at 2300 degrees for 4 hr, was determined in the temperature range 20-2600 degrees in an inert medium and in vacuum. The maximum strength was attained at the temperature 2000 degrees, above which a plastic deformation occurred. An apparatus used for the determinations is also described.
GRA

N71-38145# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
MEASURING THE DIELECTRIC CONSTANT OF MATERIALS IN THE MILLIMETRIC WAVE RANGE
V. A. Shcherbev et al 12 Mar. 1971 18 p refs Transl. into ENGLISH from Radiotekhn. (Moscow), no. 9, 1969 p 145-152
(AD-727941; FTD-HT-23-90-71) Avail: NTIS CSCL 11/8

A procedure is investigated for measuring the dielectric constant E of homogeneous and inhomogeneous substances used in the millimeter and submillimeter wave range. The determination of E is based on measuring the optical thickness of the sample or the microwave phase shift caused by the step of the investigated sample. In the experiment E was measured with the help of a phase meter operating at lambda equals 1.6 mm. Results are presented from measuring E of substances, and the measurement errors are analyzed. It is demonstrated that the measurement of accuracy as applied to substances with E

equals 2-4 is within the limits of plus or minus (0.6-1.4) percent.
GRA

N71-38146# Pennwalt Corp., King of Prussia, Pa. Research and Development Dept.
BASIC LUBRICANT STUDIES Final Report, 1 Dec. 1969 - 30 Nov. 1970
William H. Chappell May 1971 28 p refs
(Contract N00019-70-C-0255)
(AD-727577) Avail: NTIS CSCL 11/8

Materials broadly classified as solid lubricants, liquid lubricants, and lubricant additives were studied under pressures up to 70 kilobars in a diamond high pressure cell. The compositions that were examined included binary chalcogenides of molybdenum, tungsten, lead, niobium, antimony, and arsenic as well as lead oxides, zinc oxide, iodine, sulfur, and sodium sulfate. Also studied were complex chalcogenides such as thioantimonates, thiomolybdates, and thiotungstates of molybdenum, tungsten, copper, iron, silver, antimony, arsenic, cadmium, and cerium. The liquid lubricants and additives for this study were selected from straight oils, silicone oils, esters, ethers, fatty acids, phosphates, phosphites, and organometallic thio compounds. In addition to changes in density, one or more reversible color changes, changes in light transmittance, changes in birefringence, or development of phase boundaries were observed by microscopic studies for thirteen of the solids and three of the liquids. One liquid lubricant, a sperm oil, was found to solidify at 15 kilobars. Initial results of infrared studies on the effects of high pressures on As2S3 have been obtained. An X-ray diffraction unit was adapted for use with the diamond high pressure cell.
Author (GRA)

N71-38147# Air Force Systems Command, Wright-Patterson AFB, Ohio.
CREEP OF STRUCTURAL GRAPHITE IN THE 2300-3100 K RANGE
N. N. Dergunov et al 5 Mar. 1971 9 p refs Transl. into ENGLISH from Konstrukts. Materialy na Osnove Grafita (USSR), no. 4, 1969 p 108-110
(AD-727898; FTD-HT-23-95-71) Avail: NTIS CSCL 11/2

The approximation used in the investigation is described by Dergunov, et. al. (1969). The samples tested were 8 mm in diameter and 20 mm long with a d. 1.9 g/ml and strength 140 kg/cm (superscript 2) at 300 degrees K. Two types of tests were made with the samples. The samples were tested under const. temp. at 2300 degrees K and const. wt. until creep occurred, as well as at const. wt and variable temp. From the experimental results the energy of activation for creep was 47, 49, and 176 kcal/mol with the temp. ranges of 2300-2500 degrees; 2500-2900 degrees; and 2900-3000 degrees K., respectively.
GRA

N71-38148# Southwest Research Inst., San Antonio, Tex.
A STATISTICAL STUDY OF MULTIPLE-RIG ROLLING FATIGUE TESTING Phase Report, 1 Sep. 1970 - 1 Feb. 1971
E. L. Anderson and P. M. Ku Wright-Patterson AFB, Ohio AFAPL Jul. 1971 36 p refs
(Contract F33615-69-C-1295)
(AD-727759; SWRI-RS-568; AFAPL-TR-71-28) Avail: NTIS CSCL 14/2

Ten rolling fatigue testers, using a 4-ball test specimen configuration with AISI 52100 CEVM steel balls, were employed in evaluating the rolling fatigue lives of two typical aviation gas turbine lubricants, a MIL-L-7808G lubricant and a MIL-L-23699 lubricant. A total of 100 tests were conducted with each lubricant, comprising 10 tests of each of the 10 testers. The test conditions were such that the operation was definitely in the boundary lubrication regime. The rolling fatigue lives of the two lubricants under these conditions were found to be nearly the same at 90-percent confidence level. Using the results obtained, an analysis was made of the statistical implications and economic considerations involved in multiple-rig rolling fatigue testing. Factors studied were the effects of tester-to-tester variation, the number of tests, and the extent of test suspension. Precautions and techniques in multiple-rig rolling fatigue testing are discussed.
Author (GRA)

N71-38149# National Aviation Facilities Experimental Center, Atlantic City, N.J.
SMALL SCALE FIRE TESTS OF HIGH TEMPERATURE CABIN PRESSURE SEALANT AND INSULATING MATERIALS Final Report, 1970 - 1971
Constantine P. Sarkos Nov. 1971 37 p refs
(FAA-NA-71-22; FAA-RD-71-87) Avail: NTIS

A 2 sq ft stainless steel panel was constructed with the same dimensions between the fuselage skin and cabin wall as those of a titanium fuselage previously exposed to an external fuel fire. The panel was subjected to a 2 gal/hr kerosene burner which simulates the heat flux and temperature from a large JP-4 fuel fire. Testing of the panel utilizing the same materials found in the titanium fuselage caused phenomena and temperature distribution very similar to those observed during the full-scale test, thus giving credence to the test method as being representative of what would occur to a titanium or stainless-steel aircraft during a post-crash fire. Two commercially available high-temperature insulations tested without any sealant maintained survivable conditions for at least 15 minutes. Viton, a hydrofluorocarbon elastomer, was found not to flame or cause a flash-fire under conditions which silicone did. The propensity of the formation of a flash-fire was strongly influenced by the compactness of the insulation and the presence of any voids or passageways between the fuselage skin and cabin wall interface.
Author

N71-38150 Tennessee Univ., Knoxville.
A STUDY OF CONTROL SYSTEM SENSITIVITY
James Bradley Mankin, Jr. (Ph.D. Thesis) 1969 255 p
Avail: Univ. Microfilms Order No. 70-17836

A study is presented of sensitivity from a unified viewpoint which results in the development of a general formulation of the sensitivity problem. By focusing attention on its common characteristics, the sensitivity problem is organized within a common framework. Several examples are presented to illustrate the effectiveness of this formulation of sensitivity. Among these examples is the development of an algorithm which combines the computation of the state trajectory with the computation of the trajectory perturbation or the trajectory sensitivity functions. The control perturbation or control sensitivity function is included as an integral part of this algorithm. Efficient numerical methods and digital computer programs are developed to utilize these algorithms effectively. Bounds are developed for the round-off and truncation errors incurred in the computation of transition matrices. Using these bounds, an algorithm is developed for the efficent computation of transition matrices. The examples presented demonstrate that errors in the selection of computation parameters are reduced by this algorithm.
Dissert. Abstr.

N71-38151 National Lending Library for Science and Technology, Boston Spa (England).
METAL-FIBRE-REINFORCED CERAMICS: A REVIEW
Yu. E. Bussiov et al 7 Sep. 1971 23 p refs Transl. into ENGLISH from Fiz. Khim. Obrab. Mater. (Moscow), no. 1, 1970 p 57-69
(NLL-LB/G-3074-(9091.9F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 3 NLL photocopy coupons

The reinforcement of ceramic materials with refractory metals was studied to increase the strength and prevent crack propagation. The principles and technology in preparing composite materials are discussed along with basic mechanical properties of the ceramics and refractory fibers used in composites. It is concluded that it is possible to fabricate ceramic-metal-fiber composite systems, and reinforcement improves the mechanical properties, particularly the impact strength, and thermal shock resistance.
F.O.S.

N71-38152 Washington Univ., Seattle.
EFFECT OF MATRIX STRENGTHENING AND FIBER COATING ON THE MECHANICAL BEHAVIOR OF BORON-MAGNESIUM COMPOSITES
Ashok Kumar Dhingra (Ph.D. Thesis) 1970 227 p
Avail: Univ. Microfilms Order No. 70-18944

Unidirectionally aligned continuous composites of boron fibers magnesium metal matrix have been developed by liquid infiltration techniques. Reproducible quality composites with uniform periodic distribution of boron fibers have been fabricated in the form of rods, tensile bars, and plates. The mechanical properties of the composites are optimized by optimizing the volume fraction of fibers and by strengthening the matrix. It is found that composites containing 70% boron fibers show flexural strengths in excess of 350,000 psi and Young's modulus of over 48x1 million psi. The specific mechanical properties of the magnesium-boron composites are found to be higher than any other existing composite or bulk material. Dissert. Abstr.

19 MATHEMATICS

Includes calculation methods and theory; and numerical analysis. For applications see specific categories. For related information see also: 08 Computers.

N71-38153*# Perkin-Elmer Corp., Pomona, Calif. Aerospace Div.
OPTIMIZATION STUDY
L G. Hall Mar. 1971 103 p refs
(Contract NAS8-11185)
(NASA-CR-123204) Avail: NTIS CSCL 12A

Analytical expressions are developed which define the initial conditions for 100% transmission of a quadrupole analyzer and which enable combination with equations for the focal properties of an ion source. The equation for the combined properties can be used to calculate the ion current intensity of the system as a function of the gas density, parameters of the mass spectrometer and upper limits of acceptance of initial energy and initial angle. It is shown that the measurement of density is independent of the initial energy and initial angle at the time of ionization within the established upper limits. Author

N71-38154# Osaka Univ. (Japan). Lab. of Nuclear Studies.
OPERATOR FORMALISM OF DUAL RESONANCE MODEL WITH DIFFERENT TRAJECTORIES
Gaku Konisi and Takesi Saito May 1971 31 p refs
(OU-LNS-71-4) Avail: AEC Depository Libraries

In the dual resonance model the generalized harmonic oscillator formalism is constructed when relevant particles lie on different trajectories. Requiring the factorization in the sense of the operator method, one can see that the Regge intercepts are expressed in terms of quark quantum numbers. Propagator, general vertex, gauge operator and so on, appearing in the usual dual resonance model with a single trajectory, are redefined. The duality of the four-point tree diagram between general nonspurious virual states can also be shown. Author (NSA)

N71-38155*# Stanford Univ., Calif. Dept. of Computer Science.
ON GENERALITY AND PROBLEM SOLVING: A CASE STUDY USING THE DENDRAL PROGRAM
Edward A. Feigenbaum, Bruce G. Buchanan, and Joshua Lederberg Aug. 1970 50 p refs
(Grant NGR-05-020-004)
(NASA-CR-123182; SU-CS176; SU-Memo-AIM-131) Avail: NTIS CSCL 12A

The DENDRAL program was written to solve problems of inductive inference in organic chemistry. The design of DENDRAL and its performance on different problems is discussed generally. Problems attendant upon too much generality, general problem solving processes, the symbiotic relationship between generality and expertness, and implications for the study and design of problem solving systems are considered. A view of the design for a general problem solver is given, as a variant of the big-switch theory of generality. Author

N71-38156*# Connecticut Univ., Storrs. Dept. of Electrical Engineering.
DECOUPLING AND POLE PLACEMENT VIA TRANSFER MATRIX SYNTHESIS
David Jordan Sep. 1971 14 p refs
(Grant NGL-07-002-002)
(NASA-CR-123163) Avail: NTIS CSCL 12A

A transfer function matrix synthesis technique is applied to the problems of decoupling and pole placement in linear multivariable systems. It is shown that either decoupling with prefilter augmentation or arbitrary pole placement can be achieved directly by inspection and elementary matrix algebra. Previously stated conditions are confirmed. Examples are included to demonstrate the efficacy of the approach. Author

N71-38157*# Techtran Corp., Glen Burnie, Md.
OPTIMAL STRATEGY CONSTRUCTION BY TRIAL AND ERROR BASED ON PONTRYAGIN'S MAXIMUM PRINCIPLE [POSTROYENIYE OPTIMALNOY STRATEGII METODOM PROB I OSHIBOK NA OSNOVE PRINTSIPA MAKSIMUMA PONTRYAGINA]
G. M. Begelishvili Washington NASA Oct. 1971 6 p refs Transl. into ENGLISH from Soobshch. Akad. Nauk Gruz. SSR (Tiflis), v. 61, no. 2, 1971 p 297-300
(Contract NASw-2037)
(NASA-TT-F-13780) Avail: NTIS CSCL 12A

In handling a nonlinear control problem, an analog of optimal control synthesis is constructed by trial and error on the basis of Pontrysgin's principle. An example is given which illustrates the efficiency and appropriateness of the trial-and-error method. Author

N71-38158*# Reilly Translations, Gardena, Calif.
SOME APPROXIMATION EQUATIONS USEFUL IN THE PHENOMENOLOGICAL TREATMENT OF LINEAR VISCOELASTIC DATA. PART 3: APPROXIMATION EQUATIONS FOR CONVERTING STATIC MECHANICAL DATA TO DYNAMIC DATA
K. Yagii et al Washington NASA Oct. 1971 8 p refs Transl. into ENGLISH from Nippon Gomu Kyokaishi (Japan), v. 40, 1967 p 46-49 Prepared for JPL
(Contract NAS7-100)
(NASA-TT-F-14032) Avail: NTIS CSCL 12A

Approximation equations are presented which are useful for calculating the real and imaginary components of viscoelastic data, without differentiation, both quickly and directly from experimental stress relaxation and creep data. Equations for obtaining the complex modulus from the relaxation modulus are discussed including methods for finding the loss modulus (imaginary component) and the storage modulus (real component). A method for obtaining complex compliance from creep compliance is also shown. An assessment of the accuracy of the approximation equations is included. J.M.

N71-38159# Academia R. P. R., Bucharest.
ANALYTICAL SPACES
1971 171 p refs Partly in FRENCH, GERMAN, and ENGLISH Presented at the Seminar of the Math. Inst. of the Rumenian Socialist Republic, Bucharest, 25-30 Sep. 1969
Avail: NTIS

CONTENTS:

1. THE FINITENESS THEOREMS FOR Q-CONVEX AND P-CONCAVE CONFORMAL TRANSFORMATIONS AND SOME APPLICATIONS K. Knorr p 9-16 refs (See N71-38160 24-19)

2. THE PROJECTION THEOREM OF GRAUERT K. Knorr p 17-24 refs (See N71-38161 24-19)
3. CLOSED TRANSCENDENTAL SPACES AND ANALYTICAL MORPHISMS M. Jurchescu p 25-38 refs (See N71-38162 24-19)
4. RESIDUALS AND CURRENTS P. Dolbeault p 39-56 refs (See N71-38163 24-19)
5. HOLOMORPHIC FIBRES UNDERNEATH A STEIN SPACE G. Fischer p 57-69 refs (See N71-38164 24-19)
6. ON THE COHERENCE OF DIRECT IMAGES N. Kuhlmann p 71-94 refs (See N71-38165 24-19)
7. DE RHAM COHOMOLOGY FOR AN ANALYTICAL SPACE T. Bloom p 95-103 refs (See N71-38166 24-19)
8. THEOREM FOR DIVISION BY HOLOMORPHIC MATRIX AND APPLICATIONS (RESULTS OF V.P. PALAMODOV) G. Gussi p 105-128 refs (See N71-38167 24-19)
9. ON RINGS OF HOLOMORPHIC FUNCTION NUCLEI IN A BANACH SPACE H. Cartan p 129-135 (See N71-38168 24-19)
10. ZERO THEOREM IN THE BANACH CASE P. Mazet p 137-143 (See N71-38169 24-19)
11. COMPLEX ANALYTICAL STRUCTURES IN HILBERTIAN VARIATIONS D. Burghelea and A. Duma p 145-148 refs (See N71-38170 24-19)
12. SOME RESULTS IN THE THEORY OF REAL ANALYTIC SPACES A. Tognoli p 149-157 refs (See N71-38171 24-19)
13. SOME CONDITIONS IN WHICH A COMPLEX SPACE IS A STEIN SPACE C. Banica and O. Stanasila p 159-164 refs (See N71-38172 24-19)
14. TOPOLOGICAL CHARACTERIZATION OF DEPTH IN AN ANALYTICALLY COHERENT BUNDLE C. Banica and O. Stanasila p 165-171 refs (See N71-38173 24-19)

N71-38160# Academia R. P. R., Bucharest.
THE FINITENESS THEOREMS FOR q-CONVEX AND p-CONCAVE CONFORMAL TRANSFORMATIONS AND SOME APPLICATIONS [DIE ENDLICHKEITSSAETZE FUER Q-KONVEXE UND P-KONKAVE ABBILDUNGEN UND EINIGE ANWENDUNGEN]
K. Knorr *In its* Anal. Spaces 1971 p 9-15 refs In GERMAN (See N71-38159 24-19)
Avail: NTIS

The finiteness theorems of Andreotti-Grauert on q-convex and p-concave spaces are described and used to formulate a q-convex holomorphic transformation. A general criterium for projecting relative holomorphic transformations is developed that generalizes the Grauert result. Transl. by G.G.

N71-38161# Academia R. P. R., Bucharest.
THE PROJECTION THEOREM OF GRAUERT [LE THEOREME DE PROJECTION DE GRAUERT]
K. Knorr *In its* Anal. Spaces 1971 p 17-24 refs In FRENCH (See N71-38159 24-19)
Avail: NTIS

The approximation theorem of Grauert relative to holomorphic application is discussed. It is stated that X,S are complex spaces, pi:X yields S is a proper holomorphic application, and F is a coherent bundle of O sub x modules. Accordingly, the direct images R sup n pi*F, with n greater than or equal to zero, are the coherent bundles of O sub S modules. Transl. by G.G.

N71-38162# Academia R. P. R., Bucharest.
CLOSED TRANSCENDENTAL SPACES AND ANALYTICAL MORPHISMS [ESPACES ANNELES TRANCENDANTS ET MORPHISMES ANALYTIQUES]
Martin Jurchescu *In its* Anal. Spaces 1971 p 25-38 refs In FRENCH (See N71-38159 24-19)
Avail: NTIS

The analytical morphism of closed transcendental Frechet type spaces is considered for the case where topological spaces imbed in a reducable base and the base unit becomes the complex C unit. Transl. by G.G.

N71-38163# Academia R. P. R., Bucharest.
RESIDUALS AND CURRENTS [RESIDUS ET COURANTS]
Pierre Dolbeault *In its* Anal. Spaces 1971 p 39-56 refs In FRENCH (See N71-38159 24-19)
Avail: NTIS

Considered are differential cohomological forms for a variety of complex analytical surfaces. A solution is found for assessing singularities by constructing T(omega) through reduction so that X is an algebraic variable and S an algebraic sub-variable of X. Example calculations defining the residual in a closed differential meromorphic function are included. Transl. by G.G.

N71-38164# Academia R. P. R., Bucharest.
HOLOMORPHIC FIBRES UNDERNEATH A STEIN SPACE [FIBRES HOLOMORPHES AU-DESSUS D'UN ESPACE DE STEIN]
Gerd Fischer *In its* Anal. Spaces 1971 p 57-69 refs In FRENCH (See N71-38159 24-19)
Avail: NTIS

Holomorphic fiber modules in sub-spaces of a Stein space are characterized. Let (X, tau, S, Y) be a holomorphic fiber located such that the base S is a Stein space and the fiber is a Banach-Stein space. Then X is a Stein space. Transl. by G.G.

N71-38165# Academia R. P. R., Bucharest.
ON THE COHERENCE OF DIRECT IMAGES
Norbert Kuhlmann *In its* Anal. Spaces Jan. 1971 p 71-94 refs (See N71-38159 24-19)
Avail: NTIS

The analytical dependence of holomorphic mappings is studied by assuming that all complex spaces have a countable topology. The structure sheaf of a complex space X is denoted by O sub x. The following theorem is proven: Let tau : X yields Y be proper holomorphic mapping of the reduced complex space X into the reduced complex space Y. Then the space Z of level sets of tau, provided with the structure sheaf O sub z, is a reduced complex space. O sub z is the sheaf of germs of holomorphic functions on Z. G.G.

N71-38166# Academia R. P. R., Bucharest.
DE RHAM COHOMOLOGY FOR AN ANALYTICAL SPACE [COHOMOLOGIE DE DE RHAM D'UN ESPACE ANALYTIQUE]
Thomas Bloom *In its* Anal. Spaces 1971 p 95-103 refs In FRENCH (See N71-38159 24-19)
Avail: NTIS

The classical theorem of Rham is recalled. Let M be a differential and parecompact variable. Let E sup dot be the complex bundle of different form C sup infinity at complex values on M. Then the lemma of Poincare imposed in Omega yields C yields E sup dot is a solution for the bundle constant C on M. The bundles E sup p are complete hence acyclic. The H sup dot(M,C) is asymptotically equal to H sup dot(Gamma(M,E sup dot)). Transl. by G.G.

N71-38167# Academia R. P. R., Bucharest.
THEOREM FOR DIVISION BY HOLOMORPHIC MATRIX AND APPLICATIONS (RESULTS OF V. P. PALAMODOV) [THEOREME DE DIVISION PAR UNE MATRICE HOLOMORPHE ET APPLICATIONS (RESULTATS DE V. P. PALAMODOV)]
G. Gussi *In its* Anal. Spaces 1971 p 105-128 refs In FRENCH (See N71-38159 24-19)
Avail: NTIS

The fundamental principles of a theorem for division by holomorphic matrix are outlined. Matrix application as differential operator in analytical bundles, and in linear equation systems of coefficient constants in series convergence is discussed. Transl. by G.G.

N71-38168# Academia R. P. R., Bucharest.
ON RINGS OF HOLOMORPHIC FUNCTION NUCLEI IN A BANACH SPACE [SUR L'ANNEAU DES GERMES DE FONCTIONS HOLOMORPHES DANS UN ESPACE DE BANACH]
Henri Cartan *In its* Anal. Spaces 1971 p 129-135 In FRENCH (See N71-38159 24-19)
Avail: NTIS

The following theorem is proven: Let p be an ideal prime of O(E). If an ideal complete type I exists such as p = J(V(I)), then the ideal p is the final power. This theorem permits the conclusion that the surviving properties for an ideal prime p subset O(E) are equivalent: (1) p is the final power; (2) it exists a normal decomposition E = direct sum of E prime and E double prime for an ideal p; and(3) it exists an analytical germ unit X such that J(X) = p. Furthermore, the power of p is equal to the dimension of E double prime, and to the codimension of X at all regular points of X. Transl. by G.G.

N71-38169# Academia R. P. R., Bucharest.
ZERO THEOREM IN THE BANACH CASE [LE THEOREME DE ZEROS DANS LE CAS BANACHIQUE]
P. Mazet *In its* Anal. Spaces 1971 p 137-143 In FRENCH (See N71-38159 24-19)
Avail: NTIS

A theorem of zeroes for Banach cases is described. If E is a C-subspace of Banach then the ring of germes O(E) in zero contains complex analytical functions. If B is ending on A, the ideal prime of A has a nonincressing final number in B.
Transl. by G.G.

N71-38170# Academia R. P. R., Bucharest.
COMPLEX ANALYTICAL STRUCTURES IN HILBERTIAN VARIATIONS [STRUCTURES ANALYTIQUES COMPLEXES SUR LES VARIETES HILBERTIENNES]
D. Burghelea and A. Dumo *In its* Anal. Spaces 1971 p 145-148 refs In FRENCH (See N71-38159 24-19)
Avail: NTIS

A Hilbert variation C sup infinity is described that is paracompact, separable, infinitely dimensional, such that the lokal model is a Hilbert space infinitely dimensional and separable. Developed are some complex analytical structures that are non-equivalent on any Hilbert variation. It is shown that in each Hilbert variation M exists an infinite structural analytical complex of non-equivalences, such that M keeps each structure holomorphic separable and without (resp. with) unbounded holomorphic functions. Transl. by G.G.

N71-38171# Academia R. P. R., Bucharest.
SOME RESULTS IN THE THEORY OF REAL ANALYTIC SPACES
A. Tognoli *In its* Anal. Spaces 1971 p 149-157 refs (See N71-38159 24-19)
Avail: NTIS

Since to any analytical set V of U there is associated a local ringed space (V,O sub v) the following definition is obtained: Let (X,O sub x) be a local ringed space, then (X,O sub x) is said to be a real analytic space if X is paracompact, or (X,O sub x) is locally isomorphic to a ringed space associated to an analytical subset of an open set of R sup n. A real analytic space locally isomorphic to an open set of R sup n is said to be a real analytic manifold of dimension n. A ringed space (V,O sub v) is called an R-space and any ringed space locally isomorphic to such models is called a real analytic space. Some remarks on the pathology and complexification of real analytical spaces are included. G.G.

N71-38172# Academia R. P. R., Bucharest.
SOME CONDITIONS IN WHICH A COMPLEX SPACE IS A STEIN SPACE [QUELQUES CONDITIONS POUR QU'UN ESPACE COMPLEXE SOIT UN ESPACE DE STEIN]
C. Banica and O. Stanasila *In its* Anal. Spaces 1971 p 159-164 refs In FRENCH (See N71-38159 24-19)
Avail: NTIS

Let (X,O sub x) be a complex space. It is shown that the C-algebra topology gamma function (X,O sub x) of the holomorphic sections on X has a Frechet algebra structure. A Stein opening in X is by definition an opening U of X through which the complex subspace (U,O sub u = O sub x/u) imbeds. Two theorems are formulated for Stein opening characteristics that are developed from holomorphic domains. Transl. by G.G.

N71-38173# Academia R. P. R., Bucharest.
TOPOLOGICAL CHARACTERIZATION OF DEPTH IN AN ANALYTICALLY COHERENT BUNDLE [DES CARACTERISATIONS TOPOLOGIQUES DE LA PROFONDEUR D'UN FAISCEAU ANALYTIQUE COHERENT]
C. Banica and O. Stanasila *In its* Anal. Spaces 1971 p 165-171 refs In FRENCH (See N71-38159 24-19)
Avail: NTIS

The following theorem is formulated: Let X be a Stein variation of dimension n, F a coherent analytical bundle on X, and omega the sheath of germs of differential type (n,Omega) for analytical coefficients. Then an extension of O sup n-i (X,F,omega) has a Frechet space structure and its duel topology is algebraic isomorph at H sup i sub c (X,F). Transl. by G.G.

N71-38174# Academy of Sciences of the Ukranian SSR, Kiev (USSR). Inst. Teoreticheskoi Fiziki.
WEAK CONVERGENCE IN THE INFINITE TENSOR PRODUCT OF HILBERT SPACES
I. M. Burban 1971 7 p refs
(ITF-71-7-E) Avail: AEC Depository Libraries

The weakly convergent series of operators in the incomplete infinite tensor product of Hilbert spaces are investigated. It is proved that the limiting operator will be essentially self-adjoint when a dense domain exists where the sequences of partial sums of the positive operators weakly converge. Author (NSA)

N71-38175# Oak Ridge National Lab., Tenn. Mathematics Div.
NUMERICAL METHODS FOR ECOSYSTEMS ANALYSIS
J. B. Mankin and A. A. Brooks Jun. 1971 99 p refs
(Contract W-7405-eng-26)
(ORNL-IBP-71-1) Avail: NTIS

In order to aid ecologists in understanding numerical analysis and scientific applications of computers, some basic elements of numerical analysis are presented. It is intended to provide an introduction to numerical techniques to the ecologist who is unfamiliar with computing and to provide practical hints to and a reference to existing programs and their use to those ecologists who are moderately familiar with computing. Chapters on interpolation, integration, linear and nonlinear algebraic equations, eigensystems, linear and nonlinear ordinary differential equations, partial differential equations, and sensitivity analysis are included. Emphasis is placed on practical applications and the difficulties encountered in numerical computation.
Author (NSA)

N71-38176# Lockheed Missiles and Space Co., Palo Alto, Calif.
ON OSCILLATIONS ARISING IN NUMERICAL COMPUTATIONS OF DIFFERENTIAL EQUATIONS
S. I. Serlukova [1971] 13 p refs Transl. into ENGLISH from Vychisl. Matem. i Matem. Fiz., v. 11, no. 2, 1971 p 411-424
Avail: NTIS; National Translations Center, John Crerar Library, Chicago, Ill. 60616

The asymptotic of the solution of problems with discontinuous initial data in the neighborhood of a characteristic and in the neighborhood of a false characteristic is constructed. By using these asymptotics exact order estimates are obtained in L sub 1 for the deviation of the difference step from the step. Erosion of the discontinuities is observed in numerical computations of discontinuous solutions of differential equations. Author

N71-38177# Lockheed Missiles and Space Co., Palo Alto, Calif.
DIFFERENCE SCHEMES WITH A SPLITTABLE OPERATOR FOR SYSTEMS OF FIRST ORDER HYPERBOLIC EQUATIONS
M. Dryia 1971 5 p refs Transl. into ENGLISH from Vychislitelnaya Matem. i Matem. Fiz. (USSR), v. 11, no. 2, 1971 p 520-525
Avail: NTIS National Translations Center, John Crerar Library, Chicago, Ill. 60616

A difference scheme is considered with a splittable operator which approximates a system of first order hyperbolic equations for which a Cauchy problem periodic in the space variables is posed and for whose solution stability is proved. The proposed scheme is similar to the difference scheme for parabolic equations and can easily be carried over to the case of a system of equations of mixed type. Author

N71-38178# California Univ., Berkeley. Dept. of Mathematics.
ROOMY SCATTERING MATRIX SYNTHESIS
Patrick M. Dewilde 6 Aug. 1971 43 p refs
(Contract N00014-69-A-0200-1050)
(AD-728001) Avail: NTIS CSCL 12/1

The synthesis of a scattering matrix is a problem both of dynamical system theory and of operator theory. Properties relevant for synthesis are investigated based on dynamical principles as concatenation and Nerode equivalence. Then, use of operator theory in the sense of Helson and Lowdenslager is made to achieve complete decomposition of the scattering system into simple subsystems for a major class of scattering matrices, which are called 'roomy'. Hence, roomy scattering matrices prove to be completely decomposable non-normal contractive operators. Author (GRA)

N71-38179# Stanford Univ., Calif. Dept. of Statistics.
OPTIMAL CONTROL OF QUEUEING SYSTEMS WITH INTERMITTENT SERVICE
Joseph D. Blackburn 31 May 1971 169 p refs
(Contracts N00014-67-A-0112-0052; N00014-67-A-0112-0058; Grant NSF GK-2925)
(AD-728006; TR-136) Avail: NTIS CSCL 12/2

The report describes models for single-server queueing systems with Poisson arrivals and general service-time distribution which are controlled by turning the server on-and-off. The objective is an operating policy which minimizes (maximizes) expected discounted cost (reward) over an infinite horizon. Four distinct models of intermittent service systems are considered. The cost structure for these models includes fixed costs for starting-up and shutting-down the service facility, a server operating cost per unit time and either a holding cost for waiting customers or a reward for serving customers. Two of the models are based on different assumptions concerning the holding cost function. The two remaining models include provisions for balking (an arriving customer chooses not to join the queue) and reneging (customers leaving the queue without being served). For each of the models, there exists an optimal policy characterized by a pair of critical numbers (N,M): turn the server on whenever the number of customers equals (or exceeds) M and turn the server off whenever the number of customers is less than or equal to N. Algorithms for computing the optimal critical numbers are described. Author (GRA)

N71-38180# Lockheed Missiles and Space Co., Palo Alto, Calif.
FUNDAMENTAL PROPORTIONAL NAVIGATION EQUATIONS
V. L. Kan et al [1971] 8 p Transl. into ENGLISH from the book "Teoriia Proportsionalnoi Navigatsii" Leningrad, Sudostroenie Press, 1965 p 9-17
Avail: NTIS; National Translations Center, John Crerar Library, Chicago, Ill. 60616

Differential equations of motion governing the kinematics of proportional navigation are developed. Their transformation is discussed. The dynamics of the ideal motion of an axisymmetric solid with a control is considered. Differential equations are also developed for this case. K.P.D.

N71-38181# Lockheed Missiles and Space Co., Palo Alto, Calif.
PROPORTIONAL NAVIGATION FOR THE VALUE b EQUALS 2 OF THE NAVIGATION CONSTANT
V. L. Kan et al [1971] 34 p refs Transl. into ENGLISH from the book "Teoriia Proportsionalnoi Navigatsii" Leningrad, Sudostroenie Press, 1965 p 18-57
Avail: NTIS; National Translations Center, John Crerar Library, Chicago, Ill. 60616

A qualitative analysis is presented of the case under consideration. Inferences are made on the possibilities of contract, and the change in normal acceleration along the trajectory is examined. Ideal motion dynamics is investigated. Peculiarities of the case are clarified, whereby the results cannot be extended to the more general case (b greater than 2). A fundamental concept concerning stable and nonstable roots is introduced. Author

N71-38182# Kyoto Univ. (Japan). Research Inst. for Fundamental Physics.
ENERGY AND MOMENTUM IN EMBEDDED SPACE-TIMES
Klaus Buchner Jun. 1971 12 p refs
(RIFP-126) Avail: NTIS

Energy and momentum are discussed in the embedding space of the four-dimensional space-time V sub 4. In the case of a moving mass point, the force responsible for the non-conservation of the momentum can be interpreted as a force of constraint keeping matter on V sub 4. It follows that the orthogonal coordinate transformations in the space orthogonal to V sub 4 are in general not symmetry operations. Author

N71-38183# Northeastern Univ., Boston, Mass. Dept. of Physics.
EXACT SOLUTION OF THE ONE-DIMENSIONAL SCHRODINGER EQUATION WITH DELTA-FUNCTION POTENTIALS OF ARBITRARY POSITION AND STRENGTH
John F. Reading (Tex. A and M Univ.) and James L. Sigel Aug. 1971 28 p refs Submitted for publication
(Grant NSF GP-29390)
(NUB-2095) Avail: NTIS

The exact solution to the one-dimensional Schroedinger equation which describes the motion of a particle scattering off a finite set of delta function potentials of arbitrary strengths and positions is found. The behavior of the T matrix both on and off the energy shell is also given. Localization of states is discussed. Author

N71-38184*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
OPTIMAL DESIGN PROCEDURE FOR TWO-LEVEL FRACTIONAL FACTORIAL EXPERIMENTS GIVEN PRIOR INFORMATION ABOUT PARAMETERS
Steven M. Sidik and Arthur G. Holms Washington Nov. 1971 39 p refs
(NASA-TN-D-6527; E-6223) Avail: NTIS CSCL 12A

Optimal design procedures by posing the experimental design problem as a finite decision problem are developed. Bayes and mini-max design strategies are then derived and their application illustrated. The major computational step is the evaluation of all possible matchings of physical variables to the abstract variables of all potential designs. The technique of telescoping sequences of blocks permits the consideration of experiments to be performed in stages. Author

N71-38185 National Lending Library for Science and Technology, Boston Spa (England).
GRAPHICAL PROCESSING OF DATA BY THE MOIRE AND COORDINATE GRID METHODS, PART 2
P. I. Polukhin et al 12 May 1971 11 p refs Transl. into ENGLISH from Izv. Vyssh. Uchob. Zaved. (USSR), v. 1, 1971 p 90-95
(NLL-M-21006-(5828.4F)) Avail: Natl. Lending Library, Boston

Spa, Engl.: 1 NLL photocopy coupon

A discussion is presented of problems in the graphical processing of displacement fields, obtained by the moire and coordinate grid methods, with the aim of obtaining partial derivatives of the displacements. The proposed method simplifies the process of calculating deformations, especially when utilizing a coordinate grid. Author

N71-38188 Pennsylvania Univ., Philadelphia.
IDENTIFICATION AND OPTIMIZATION IN A STOCHASTIC ENVIRONMENT
Ranendra Kumar Bhattacharyya (Ph.D. Thesis) 1969 200 p
Avail: Univ. Microfilms Order No. 70-16127

The problem of choosing a model to represent a linear plant of unknown characteristics under a stochastic environment, and of designing an optimal feedback controller based on the representation of the plant as described by the model is investigated. The plant and its stochastic environment have been simulated in a digital computer as a linear differential equation with white gaussian noise superimposed on its forcing function. The states of the plant have been assumed to be observable, and white gaussian measurement errors have been superimposed on the sampled values of the observed data. An econometric model has been formulated for a production process, and the optimal scheduling problem has been worked out using a discrete version of Pontryagin's Maximum Principle. The results are compared with those obtained by linear programming for a linear production process. Dissert. Abstr.

N71-38606# Academy of Sciences (USSR), Moscow.
STATISTICAL ANALYSIS OF HYPOTHESES
Yu. I. Serebrennikov *In its* Proc. of the 6th Ann. All-Union Winter School on Space Phys., part 2 1969 p 85-106 refs In RUSSIAN (See N71-38582 24-30)
Avail: NTIS

N71-38607# Academy of Sciences (USSR), Moscow.
ANALYSIS OF LATENT PERIODICITIES AND THE POSSIBILITY OF STATISTICAL PREDICTION
O. B. Vasilyev *In its* Proc. of the 6th Ann. All-Union Winter School on Space Phys., part 2 1969 p 107-114 refs In RUSSIAN (See N71-38582 24-30)
Avail: NTIS

N71-38608# Academy of Sciences (USSR), Moscow.
A RAPID FOURIER TRANSFORMATION
K. A. Kandaurova *In its* Proc. of the 6th Ann. All-Union Winter School on Space Phys., part 2 1969 p 114 refs In RUSSIAN (See N71-38582 24-30)
Avail: NTIS

N71-38616# Academy of Sciences (USSR), Moscow.
ONE POSSIBILITY FOR APPROXIMATING A CURVED LATITUDINAL PATH
A. S. Inchin, A. Manshalina, Yu. I. Okulov, and I. A. Pimenov *In its* Proc. of the 6th Ann. All-Union Winter School on Space Phys., part 2 1969 p 130-132 refs In RUSSIAN (See N71-38582 24-30)
Avail: NTIS

N71-37757# Joint Publications Research Service, Washington, D.C.
MATHEMATICAL MODELS OF PLANNING AND CONTROL OF SCIENTIFIC RESEARCH
F. G. Gurvich *In its* Computer Analysis and Mathematical Modeling 1 Oct. 1971 p 16-24 refs (See N71-37755 24-06)
Avail: NTIS

20 METEOROLOGY

Includes climatology; weather forecasting; and visibility studies. For related information see also: 13 Geophysics; and 30 Space Sciences.

N71-38187*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
STATISTICAL DATA FROM NASA'S 150-m WIND TOWER AT KENNEDY SPACE CENTER, FLORIDA
Kelly Hill 30 Jul. 1971 48 p refs
(NASA-TM-X-64612) Avail: NTIS CSCL 04B

A statistical summary of ground wind data recorded at the 150-m wind tower on Merritt Island is presented. Three years (1966-1968) of hourly 10-min mean wind speed measurements were classified as a function of wind direction and periods of reference (annual, summer, winter, morning, daytime, evening, and nighttime). Cumulative percentage frequency distributions were computed with these data at seven tower levels to obtain percentiles of wind speed (50, 84.1, 97.8 and 99 percent). Data are also included to show the percentage frequency of wind speed observations by directions. These percentiles approximate for a normal distribution the mean and mean plus 1, 2, and 3 standard deviations, respectively. However, it should be recognized that the scalar wind distributions are not represented adequately by a normal distribution function but more appropriately by a Rayleigh distribution. Author

N71-38188# Comitato Nazionale per l'Energia Nucleare, Rome (Italy).
THE CASACCIA CENTER FOR NUCLEAR STUDIES, 1968 [CENTRO STUDI NUCLEARI DELLA CASACCIA, 1968]
P. Cegnetti, C. Flenghi, G. Giudici, and V. Martinelli 30 Nov. 1970 100 p In ITALIAN
(RT/PROT-(70)42) Avail: AEC Depository Libraries

A short description is presented of observed atmospheric phenomena and currently used climatological methods, with emphasis of the salient features of the meteorological year 1968. Author (NSA)

N71-38189*# Allied Research Associates, Inc., Concord, Mass.
DEVELOPMENT OF FOUR-DIMENSIONAL ATMOSPHERIC MODELS (WORLDWIDE) Final Report
David B. Spiegler and James R. Greaves Aug. 1971 97 p refs
(Contract NAS8-25618)
(NASA-CR-61382) Avail: NTIS CSCL 04B

Mean monthly values and daily variances of moisture, temperature, density, and pressure were generated at 1 km intervals from the surface to 25 km using global atmospheric data extracted from various sources. The resultant profiles were stratified into homogeneous moisture regions covering both hemispheres. Analytic functions were developed to fit the mean and daily variance profiles within each region. Given the latitude, longitude and month, the mean and daily variance profiles of all four atmospheric parameters can be generated. These profiles can then serve as input to attenuation models that predict the degree of atmospheric attenuation likely to be encountered by satellite or air-borne electromagnetic sensors engaged in earth resources observations. Detailed moisture profiles for two radiosonde locations along the mid-Atlantic Coast and the Gulf Coast were analyzed and 12- and 24-hour conditional tables of moisture amount were generated at kilometer levels. The feasibility of developing frequency distributions of moisture content profiles was investigated using the data from the two radiosonde stations. Author

N71-38190# Los Alamos Scientific Lab., N.Mex.
BETA RADIOACTIVITY IN ENVIRONMENTAL AIR AND PRECIPITATION AT LOS ALAMOS, NEW MEXICO, 1970
William R. Kennedy and Jack Aeby May 1971 9 p

(Contract W-7405-eng-36)
(LA-4661) Avail: NTIS

Beta activity of particulate matter of both air and precipitation for 1970 is reported for Los Alamos, New Mexico. The lower monthly average levels found in precipitation collections and the slightly higher levels found in the air samples indicate that 1970 was a drier year than 1969 with 14.93 and 25.67 in. of precipitation, respectively. Author

N71-38191# Commonwealth Scientific and Industrial Research Organization, Melbourne (Australia). Div. of Meteorological Physics.
[PHYSICAL PROCESSES CONTROLLING WEATHER AND CLIMATE] Annual Report, 1969-1970
[1970] 41 p refs
(NP-18828) Avail: AEC Depository Libraries

The main purpose of this research organization is to gain a more complete understanding of the basic physical processes which control weather and climate. A major field of study has been micrometeorology, including turbulence, which is interrelated with upper atmosphere research; air-sea interaction; agricultural meteorology including hydrology, evaporation, and plant-environment interaction; atmospheric pollution; and atmospheric and terrestrial radiation levels. Experimental research in each of these subjects is discussed. NSA

N71-38192# International Geophysical Year World Data Center A, Washington, D.C.
HIGH ALTITUDE METEOROLOGICAL DATA, JANUARY 1970, VOLUME 7, NO. 1
Asheville, N. C. NOAA 1971 278 p
Avail: SOD $3.00

Wind and temperature measurements from all available meteorological sounding rocket firings are presented, along with computed values for pressure, density, and speed of sound. Local radiosonde observations nearest the time of firing are included. Author

N71-38193# Commonwealth Scientific and Industrial Research Organization, Aspendale (Australia). Div. of Meteorological Physics.
A RADAR-STATISTICAL ANALYSIS OF NON-FRONTAL THUNDERSTORMS
F. A. Berson 1971 26 p refs *Its* Tech. Paper No. 20
Avail: NTIS

Aspects of convective storm behavior are investigated statistically using radar observations made at the Brisbane airport in connection with aviation approach control. Distributions and correlations are derived for a large number of measured and deduced echo variables; in particular, summit height of cells, reflectivity factor, and parameters of storm movement and growth. A simple method of data stratification is applied in order to separate differences between individual storms and changes during their life history. Mean values and distributions of the variables are discussed in relation to the assessment of severe turbulence and hail. The study indicates, among other things of interest to the aviation meteorologist, that the SH mechanism is operative in severe storms. This mechanism, first proposed by Browning and Ludlam, implies backing of a storm cell to the high pressure side (usually to the left in the Southern Hemisphere) of the mean wind. In more general terms, it is shown that there is an absence of constraint in straight-line propagation of cells which is in contrast with evidence for constraints on speed of movement, growth, and intensification. Author

N71-38194# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CHARACTERISTICS OF SCATTERING AND ATTENUATION OF MICRORADIOWAVES IN PRECIPITATIONS
Yu. A. Dedali et al 31 Mar. 1971 32 p refs Transl. into ENGLISH from Tr. Vysokogornyi Geofiz. Inst., Nalchik (USSR), no. 13, 1969 p 153-171
(AD-727161; FTD-HC-23-67-71) Avail: NTIS CSCL 04/2

An analysis of raindrop size distribution curves recorded in various parts of the world is given. The rain studied is divided into three types with respect to microstructural features. Each type of rain may be characterized by a family of two analytical functions - namely, the inverse power law and the gamma distribution for moderate and large values of the distribution index. Calculations of radar reflectivity are performed for these two functions. The great variability of the Z-I and k-I relations with respect to the parameters of the distribution function is shown. Author (GRA)

N71-38195# South Dakota School of Mines and Technology, Rapid City. Inst. of Atmospheric Sciences.
A 50-CM FOG DISDROMETER
Harlan L. Feller (M.S. Thesis) May 1971 65 p refs
(Contract N00014-68-A-0160)
(AD-727184) Avail: NTIS CSCL 04/2

A description is given of an ultra-sensitive disdrometer to be used in the analysis of fogs and aerosols. This device operates on a wavelength of 0.9 microns over a 50-cm path and utilizes the principles of optical transmission and scattering of light by small particles. It was originally developed to analyze aerosols composed of particles as small as 1 micron and as large as 14 microns in diameter. The primary region of operation is in the 97.0 to 99.9 percent transmission coefficient range with an ascribed sensitivity of 4 parts in 100,000. The device is capable of determining the average size and average density of particles per cubic centimeter of light to moderate fogs. Other suggested uses of this disdrometer include the investigation of smokes, hazes, and air pollution. Author (GRA)

N71-38196# South Dakota School of Mines and Technology, Rapid City. Inst. of Atmospheric Sciences.
THE EFFECT OF LIQUID WATER CONTENT ON NUCLEATION EFFICIENCY IN A COLD CHAMBER
Dianne Dorland (M.S. Thesis) 1970 83 p refs
(Contract N00014-68-A-0160)
(AD-727183) Avail: NTIS CSCL 04/2

Detailed studies have been carried out concerning the importance of liquid water content on nucleation efficiencies of a wide variety of cloud seeding generators at temperatures between -5 C to -20 C. Earlier work by Steele and Davis has indicated that increases in efficiencies of three orders of magnitude can be realized with increased liquid water content at temperatures around -12 C, while little effect was apparent at -20 C. The importance of contact nucleation at the warmer temperature regions was also studied to determine if this process could theoretically cause increased efficiencies with increases in liquid water. Evaluation of experimental data, herein described, show no significant increase in efficiencies as the liquid water content varies from 1.0 gm/cubic meter to 8.0 gm/cubic meter. Both the theoretical and experimental data appear to support the premise contact nucleation is less important than sublimation and condensation when the initial nuclei concentration is 100,000 particles/cc or less. Author (GRA)

N71-38197# Cornell Aeronautical Lab., Inc., Buffalo, N.Y.
ADVANCES IN DOPPLER WEATHER RADAR OBSERVING METHODS AND DATA PROCESSING TECHNIQUES Final Report
Calvin C. Easterbrook Jul. 1971 21 p refs
(Contract N00014-70-C-0397)
(AD-727138; CAL-VC-2975-P-1) Avail: NTIS CSCL 04/2

A continuing objective of the Navy-sponsored, Doppler radar studies has been to develop the operational utility of the radar, both as a weather research tool and as an observing instrument useful for specialized, short-term forecasting. To fill this role effectively, observing techniques and data processing methods must be developed that will permit a single Doppler radar to work alone. The work discussed in this report deals with

attempts to push even further the utility of single component measurements in describing the total wind field. First, a curve fitting technique is described which provides estimates of the horizontal wind from small azimuth sector scans. Using this method, it is possible to get independent estimates of the wind vector at many different points in space and thus learn something of the spatial variability of the wind. The single parameter curve fitting technique is then extended to two dimensions. It is shown how the area fitting technique provides the means to compute the spatial derivatives of the wind field directly from a single, small sector scan. Author (GRA)

N71-38198# Bowles Fluidics Corp., Silver Spring, Md.
DEVELOPMENT OF A METEOROLOGICAL TWO-AXIS WIND SENSOR Final Report, 1 Jun. 1970 - 31 May 1971
Vincent F. Neradka and Robert F. Turek Jul. 1971 57 p refs
(Contract N00014-70-C-0338)
(AD-727220; R-7-31-71) Avail: NTIS CSCL 04/2

The concept of a single axis fluidic wind sensor has been extended to a two axis system for meteorological applications. A no-moving-part concept for providing wind speed and angle was investigated at length with regard to sensor configuration and angle resolving techniques. An engineering model of a two axis sensor was built and wind tunnel tested with one of the major aims being the attainment of a cosinusoidal variation in output signal with angle of incidence of the sensor to the wind. In this way, the computation of wind information from the measured orthogonal components is simplified. Tests were conducted over the velocity range $0.5 < v < 160$ ft/sec and over 360 degrees rotation of the sensor with respect to the wind. A single axis sensor was successfully wind tunnel tested in a contaminated environment. Author (GRA)

N71-38199# Freie Univ., Berlin (West Germany). Inst. fuer Meteorologie und Geophysik.
METEOROLOGICAL DATA. VOLUME 83, NO. 1: DAILEY AND MONTHLY NORTHERN HEMISPHERE 5-MILLIBAR-SYNOPTIC WEATHER MAPS OF THE YEAR 1967 Quarterly Technical Status Report, Oct. - Dec. 1967
Barbara Kriester, Karin Labitzke, Karin Petzoldt, and Karl Sieland 1970 112 p
(Contract DAJA37-71-C-0993)
(AD-727699; QTSR-1) Avail: NTIS CSCL 04/2

The present volume contains a series of stratospheric weather maps for the 5-mb level. Included are daily height and temperature analyses for three months for the northern hemisphere based on radiosonde and rocketsonde measurements and performed by using a hydrostatic build-up method. The corresponding monthly mean maps and their variations are included as well as the mean grid point data and their latitudinal, calculated from the daily values. Moreover, the circulation pattern during the period under consideration is described with special emphasis on the processes at polar latitudes. Author (GRA)

N71-38200# Army Foreign Science and Technology Center, Charlottesville, Va.
CHEMICAL COMPOSITION OF THE ATMOSPHERIC PRECIPITATION OF THE USSR [KHIMICHESKIY SOSTAV ATMOSFERNYKH OSADKOV NEKOTORYKH RAYONOV SSSR]
A. A. Matveev et al 2 Aug. 1971 25 p refs Transl. into ENGLISH from Gidrokhim. Materialy (Moscow), v. 42
(AD-727957; FSTC-HT-23-096-71) Avail: NTIS CSCL 04/2

The chemical composition of precipitation in various regions of the USSR is presented. Conclusions are reached as to the alteration and formation of chemical precipitation in specific geographic zones. Author (GRA)

N71-38201# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE INVESTIGATION OF ATMOSPHERIC TURBULENCE IN ANTARCTICA BY A RADIO PROBING METHOD
V. K. Babarykin et al 1 Jun. 1971 14 p refs Transl. into ENGLISH from Antarktika. Dokl. Komis 1965 (Moscow), 1966 p 82-86
(AD-727870; FTD-MT-24-61-71) Avail: NTIS CSCL 04/2

In 1963 the Eighth Antarctic Expedition made observations of atmospheric turbulence at Mirnyy. About 100 radiosondes with acceleration attachments were launched. Data from 81 ascents were processed. Launchings were at 0000 and 1200 hours. Best data were obtained to altitudes 10-11 km; altitudes of 20 km were reached by 70 percent of the radiosondes, 30 km by 7-10 percent. The frequency of turbulence aloft was computed for the number of cases for each kilometer layer of the atmosphere. A particular kilometer layer was considered turbulent if it contained a turbulent layer more than 50 m thick. The frequency of turbulence relative to the tropopause and maximum wind is shown graphically in a figure. The figure shows the distribution of weak, moderate and strong turbulence relative to the tropopause. Author (GRA)

N71-38202*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
THE GENESIS OF SUDDEN STRATOSPHERIC WARMINGS AND THE QUASI-BIENNIAL CYCLES
J. W. Smith Washington Oct. 1971 27 p refs
(NASA-TN-D-6522; M-176) Avail: NTIS CSCL 04B

A mechanism believed to be responsible for sudden stratospheric warmings, as well as biennial cycles in temperature, wind, ozone, pressure, and perhaps precipitation and the January thaw, is discussed. These biennial cycles are caused by hemispheric exchanges of air in the stratosphere. The hemispheric exchanges are caused by unequal heating of the hemispheres because of the ellipticity of the earth's orbit. The resulting annual atmospheric surges are minimized or omitted during the 11-year sunspot minima, resulting in long-term mean cycles of about 26.4 months. Author

N71-38203# Naval Weather Service, Washington, D.C.
SUMMARY OF SYNOPTIC METEOROLOGICAL OBSERVATIONS, HAWAIIAN AND SELECT NORTH PACIFIC ISLAND COASTAL MARINE AREAS. VOLUME 5: AREA 14, SAIPAN; AREA 15, GUAM; AREA 16, YAP; AREA 17, KOROR
Jun. 1971 642 p
(AD-727900) Avail: NTIS HC $9.00/MF $0.95 CSCL 04/2

The data contained in these tables were obtained from tape data Family 11 (TDF-11), Marine Surface observations. TDF-11 was primarily funded by the Naval Weather Service Command and selected by NWSED Asheville as the most comprehensive collection of marine surface observations from which to develop a series of coastal marine summaries. GRA

N71-38204# Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colo.
AREAL SNOW COVER AND DISPOSITION OF SNOWMELT RUNOFF IN CENTRAL COLORADO
Charles F. Leaf Mar. 1971 23 p refs Supported in part by Bur. of Reclamation Prepared in cooperation with Colo. State Univ. and Bur. of Reclamation
(USDA-FSRP-RM-66) Avail: NTIS

The processes which produce stream runoff from snowmelt are too varied and too complex to be completely defined at this time. Hence, relatively simple relationships have been derived which empirically relate the more important factors in the hydrologic cycle for practical usage. Included in these types of relationships are correlations of the areal extent of snow cover with snowpack volume and streamflow. Such relationships have important application in operational streamflow forecasting, and hydrologic analysis of snow zone watersheds. Author

N71-38205 National Lending Library for Science and Technology, Boston Spa (England).
ANNUAL AND LONG-TERM VARIATIONS OF THE DEPTH

AND POSITION OF THE ALEUTIAN LOW FROM 1899 TO 1951
I. V. Maksimov et al [1971] 13 p refs Transl. into ENGLISH from Izv. Vses. Geog. Obsc. (USSR), no. 102, 1970 p 422-431 (NLL-M-20744-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The location of the center of the Aleutian low, and the pressure at the center were studied using U.S. Weather Bureau monthly mean sea-level pressure charts for 1899 to 1951. The center was determined as the geometrical center of the inner isobar. The lowest monthly mean pressure observed was 979 mb in January 1931, and the mean coordinates of its center were 54.8 N, and 168.6 W. It is suggested that variations of solar activity and the long-period component of the tide-generating forces are the main factors in the position and intensity of the Aleutian low. F.O.S.

N71-38206 National Lending Library for Science and Technology, Boston Spa (England).
ATMOSPHERIC DIFFUSION OF IMPURITIES IN CALMS
M. E. Berljand et al 1969 14 p refs Transl. into ENGLISH from Glav. Geof. Obs. (Leningrad), v. 238, 1969 p 3-13 (NLL-M-20351-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupon

Calculation of diffusion equations for conditions of calm is discussed. Diffusion under conditions of turbulent exchange and no wind is considered. Equations are developed for this case. An equation is presented for maximum surface impurity concentration in either windy or windless cases. K.P.D.

N71-38207 Texas Univ., Austin.
AN INVESTIGATION OF CLOUDS AND PRECIPITATION FOR THE TEXAS HIGH PLAINS
Donald Robert Haragan (Ph.D. Thesis) 1970 138 p
Avail: Univ. Microfilms Order No. 70-18244

A study of the relationship among cloudiness, precipitable water vapor, water vapor flux, stability, and precipitation is presented for the Texas high plains. A cloud census gives the annual and diurnal variations of cloud types and amounts in the area. The census reveals that the most common cloud types are altocumulus and cirrus. Total cloud cover is greatest during winter and least during the fall. A study of clouds during periods of above normal rainfall indicates that precipitation during late fall and winter is associated with stratiform clouds which develop in conjunction with cyclonic activity. Spring and summer precipitation is most highly correlated with cumuliform clouds characteristic of convective activity. Periods of above normal precipitation in the plains area are associated with above normal cloud amounts, while dry periods are generally lacking in clouds. An exception is summer cumulus which occurs with surprising regularity during both dry and wet periods. Dissert. Abstr.

N71-38208 Colorado State Univ., Fort Collins.
A THEORETICAL INVESTIGATION OF CONVECTIVE PATTERNS IN THE LEE OF THE COLORADO ROCKIES
Richard Allen Dirks (Ph.D. Thesis) 1970 137 p
Avail: Univ. Microfilms Order No. 70-20011

An explanation of convective patterns is proposed on the basis of a regional scale Rocky Mountains Great Plains circulation system. A two-dimensional numerical model of a large scale mountain-plain circulation is presented which includes the effect of a slightly sloping plain. The equations are integrated over periods of two to eight hours for various initial conditions of thermal stability and ambient wind. Typical observed stability and ambient wind fields yield an interacting two cell circulation with a strong cell over the mountain slope and a weaker cell over the plain. The resulting airflow is characterized by strong descent in the immediate lee of the mountains and weak ascent in a broad region 100 to 300 km leeward. An investigation of contributing factors reveals the effect of the plain slope to be a primary cause of the ascending flow over the plain. Dissert Abstr.

N71-38209 Wisconsin Univ., Madison.
A DIAGNOSTIC MODEL OF THE TROPICAL CYCLONE IN ISENTROPIC COORDINATES
Richard Allen Anthes (Ph.D. Thesis) 1970 203 p
Avail: Univ. Microfilms Order No. 70-15877

A diagnostic axisymmetric model in isentropic coordinates was developed to study the effect of differential heating on the dynamics and energetics of the steady-state tropical cyclone. From the thermal forcing specified by various heating distributions, realistic slowly varying solutions for the mass and momentum fields were obtained by an iterative technique. The theory of available potential energy for open systems was utilized to study the energy budget for the mature hurricane. In the slowly varying state, the gain of available potential energy by diabatic heating and lateral boundary processes balances the conversion of potential to kinetic energy. For an open domain with radius 500 km from the hurricane center, the boundary flux of available potential energy is about 40 per cent of the generation by diabatic heating. For a domain with radius 1000 km, however, the boundary flux is about 15 per cent of the generation. Dissert. Abstr.

21 NAVIGATION

Includes guidance; autopilots; star and planet tracking; inertial platforms; and air traffic control. For related information see also: 07 Communications.

N71-38210# Royal Aircraft Establishment, Farnborough (England).
SEVENTH MEETING OF THE NAT SYSTEMS PLANNING (SPANISH DELEGATION)
Apr. 1971 88 p Transl. into ENGLISH from the Spanish report (RAE-LIB-TRANS-1580) Avail: NTIS

Details are given of the aircraft traffic over the North Atlantic for the years 1966 to 1969. An estimation of the minimum time routes to North America is made together with a comparative study of flights at various Mach numbers and below level 310. Penalties are given for deviations of 2 deg in latitude from these minimum time routes. In a mathematical study, the numbers of tracks necessary for the period 1970 to 1980 are worked out, leading to work on track compensation and the establishment of the NAT structure for each characteristic meteorological situation, with particular emphasis on an equable distribution of penalties between users from various geographical regions. Author

N71-38211# National Bureau of Standards, Washington, D.C. Signal Lighting Group.
DEVELOPMENT, TESTING, AND EVALUATION OF VISUAL LANDING AIDS Consolidated Progress Report, 1 Jan. - 31 Mar. 1971
1 Jul. 1971 12 p refs Sponsored by the Navy and FAA (NBS-10604) Avail: NTIS

Continuing research of visual landing aids is reported and includes the results of studies on: (1) visibility meters and their application, and (2) airfield lighting and marking. The operational performance of two models of backscatter visibility meters is described, and modifications made to enhance their performance are discussed. Another research effort involved an analysis of sky luminance measurements as a consideration of factors affecting the visual range of runway lights. An investigation was made to determine the performance characteristics of selected organic coatings for use on panels of control tower consoles. The coatings systems were tested for abrasion resistance, adhesion, and stain resistance. Tables are presented of the results obtained. In another study, the performance of a narrow-beam deck floodlight using a 400-watt high pressure sodium lamp was evaluated. The characteristics of the lamp as compared to those of incandescent fixtures is discussed. D.L.G.

N71-38212*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
PRELIMINARY DETERMINATION OF SPACECRAFT TRAJECTORIES USING ON-BOARD OPTICAL MEASUREMENTS
John D. McLean Washington Oct. 1971 90 p refs
(NASA-TN-D-6551; A-3522) Avail: NTIS CSCL 22A

The problem of determining the trajectory of a spacecraft from onboard optical measurements without a priori information is discussed. Only sufficient information to determine the trajectory is used, and it is assumed that this preliminary estimate will be improved later by the use of differential corrections and redundant data. Five basic types of measurements, representing instruments considered feasible or within the state of the art, are considered. The effects of random and bias type measurement errors and interpolation errors arising from nonsimultaneous measurements are analyzed. Only observations of the central body and two stars are considered. Within certain limitations all five types of measurements will give satisfactory results. Two important factors discussed are the proper choice of stars and the calibration for eliminating bias errors. Author

N71-38213# Federal Aviation Administration, Washington, D.C. Office of Aviation Economics.
FAA PROGRAM EFFECTIVENESS AND FACILITY CRITERIA. AN ANALYSIS OF THE COSTS AND EFFECTIVENESS OF AIR TRAFFIC CONTROL TOWERS
James Gensle Apr. 1971 92 p
Avail: NTIS

Analytical data was developed on the effectiveness of VFR control towers. The results of a research effort which was conducted as a special issue study are presented. The analytical substance is included, as well as summaries of two interim reports prepared earlier and a summary of a draft report by the National Bureau of Standards. The major finding, based on statistical analysis, is that for airports with low and medium amounts of annual traffic, those airports with VFR control towers have a significantly lesser rate of aircraft accidents than airports without towers. Another finding indicates that VFR towers can help to reduce aircraft time in approach and landing at airports. Author

N71-38214# Federal Aviation Administration, Washington, D.C. Systems Research and Development Service.
SRDS PROGRAM: GOALS, ACHIEVEMENTS, TRENDS, 1 APRIL 1970 - 31 MARCH 1971
31 Mar. 1971 159 p refs
Avail: NTIS

The material is presented in separate chapters for each of the SRDS technical development divisions: Air Traffic Control, Communications, Navigation, Frequency Management, Systems Analysis, and Aircraft. Subprograms are listed in sequential numeric order along with key descriptive words on each effort. Author

N71-38215 Air Traffic Control Evaluation Unit, Bournemouth (England).
AN EVALUATION OF THE AUTOMATIC FLIGHT PROGRESS STRIP CUTTER AND LOADER
A. E. Windebank and T. Anderson Jun. 1971 17 p
(ACTEU-330) Avail: Issuing Activity

The results are presented of performance evaluation tests conducted on the strip cutter and loader machine to determine its acceptibility for use at air traffic control centers. The function of the machine is to cut and load flight progress strips in page form, and it was designed to load into special plastic strip holders which were modified to work with the machine. The evaluation tests consisted of an analysis of the percentage of misloaded strips and strips not loaded in comparison with the total number of loads. In addition, cutter wear and the noise level of the machine were assessed. Based on the results, the machine was judged to be acceptable for operational use. D.L.G.

N71-37744# Eurosystem, Paris (France).
MADAP: A COMPUTERIZED AIR-TRAFFIC CONTROL SYSTEM
Leon Borocin *In* Inform. Process. Assoc. of Israel Proc. of the Natl. Conf. on Data Process. 1970 p E19-E33 (See N71-37742 24-08)
Avail: NTIS HC $6.00/MF $0.95

N71-37883# Standard Electrik Lorenz A. G., Stuttgart (West Germany).
TIME DISSEMINATION BY SATELLITES
H. C. Freiesleben *In* Max-Planck-Inst. fuer Aeronomie Future Appl. of Satellite Beacon Expt. Nov. 1970 3 p (See N71-37883 24-13)
Avail: NTIS HC $6.00/MF $0.95

N71-37886# Deutsche Lufthansa Aktiengesellschaft, Hamburg (West Germany).
PROBLEMS OF AIR NAVIGATION
J. P. Hach *In* Max-Planck-Inst. fuer Aeronomie Future Appl. of Satellite Beacon Expt. Nov. 1970 6 p (See N71-37883 24-13)
Avail: NTIS HC $6.00/MF $0.95

N71-37904# Paris Univ. (France). Lab. de Physique de l'Atmosphere.
CORRECTION OF THE IONOSPHERIC ERROR IN DISTANCE MEASUREMENTS
R. Hanbeba and J. Paper-Lepine *In* Max-Planck-Inst. fuer Aeronomie Future Appl. of Satellite Beacon Expt. Nov. 1970 11 p refs (See N71-37883 24-13)
Avail: NTIS HC $6.00/MF $0.95

N71-37917# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany).
PRELIMINARY RESULTS OF DOPPLER MEASUREMENTS FOR NAVIGATION BY SATELLITES
A. Wellenhauer and O. Weber *In* Max-Planck-Inst. fuer Aeronomie Future Appl. of Satellite Beacon Expt. Nov. 1970 10 p refs (See N71-37883 24-13)
Avail: NTIS HC $3.00/MF $0.95

N71-37920# Max-Planck-Institut fur Aeronomie, Lindau Uber Northeim (West Germany).
DISCUSSION NOTE ON PROBLEMS OF SEA NAVIGATION
Gerhard Zickwolff (DHI, Hamburg) *In its* Future Appl. of Satellite Beacon Expt. Nov. 1970 5 p refs (See N71-37883 24-13)
Avail: NTIS HC $3.00/MF $0.95

22 NUCLEAR ENGINEERING

Includes nuclear reactors and nuclear heat sources used for propulsion and auxiliary power. For basic research see: 24 Physics, Atomic, Molecular, and Nuclear. For related information see also: 03 Auxiliary Systems; and 28 Propulsion Systems.

N71-38216# Allgemeine Elektricksets-Gesellschaft, Groesweizheim (West Germany).
NUCLEAR SUPERHEAT REACTOR KAHL (HDR). RESEARCH AND DEVELOPMENT PROGRAM (PHASE B) Final Report [HEISSDAMPFREAKTOR KAHL FORSCHUNGS- UND ENTWICKLUNGSPROGRAMN (PHASE B) SCHLUSSBERICHT]
H. J. Eisfelder Oct. 1970 127 p refs In GERMAN; ENGLISH summary
(BMBW-FBK-70-22) Avail: AEC Depository Libraries

The development of an angular superheat fuel rod between 1964 and 1968 is described. The cladding materials program included corrosion and heat resistance tests leading to the choice of Inconel 625 or IN 102 for the superheater can and of 16/16 or 16/13 Cr/Ni steels for the boiler can. In thermocycling tests canning materials and end plugs were tested within complete angular fuel rods. Fuel rods of different design and material combinations were irradiated. After a maximum 546 days irradiation a peak burn up of 11.3 MWd/kg was achieved. A prototype bundle was fabricated and handling tests were performed. Author (NSA)

N71-38217# Japan Atomic Energy Research Inst., Tokyo.
JFM: A CODE FOR THE JMTR FUEL ACCOUNTABILITY
Rokuro Oyamada Dec. 1970 53 p In JAPANESE; ENGLISH summary
(JAERI-Memo-4270) Avail: AEC Depository Libraries

The JFM is a code for accounting the JMTR fuel (except fuel specimen for irradiation test). In programming, an effort was made so that the output of the code can be used as a fuel accountability report for the nuclear fuel section by itself. Author (NSA)

N71-38218# Kernforschungszentrum, Karlsruhe (West Germany). Institut fuer Reaktorentwicklung.
INVESTIGATION OF THE NATURAL FREQUENCY OF THE NORMAL AND ELONGATION FUNCTION, AND OF THE DAMPING OF THE INSTRUMENTED MODEL FUEL RODS OF THE Na 1/2 MODEL SUBASSEMBLIES [UNTERSUCHUNG DER EIGENFREQUENZEN, DER NORMAL- UND DEHNUNGSFUNKTIONEN UND DER DAEMPFUNG DER INSTRUMENTIERTEN MODELLBRENNSTAEBE DES Na 1/2 MODELLSUBASSEMBLYS]
W. Krueger and R. Schwemmle Dec. 1970 54 p refs In GERMAN; ENGLISH summary
(KFK-1337; EUR-4572-D) Avail: AEC Depository Libraries

Investigations on free lateral vibration of fuel pins of the instrumented subassembly mock-up of the sodium-cooled fast breeder reactor design Na-1 are described. The influence of the axial distribution of spacer grids on natural frequencies and the corresponding vibration modes was calculated and verified by experiments. The influence of the radial clearance in cells of spacer grids on the change of the normal modes was investigated experimentally. The frequency response functions of the miniature pressure transducers were measured. The transducers were mounted in one pin and in the subassembly sheath for the detection of the boundary layer pressure fluctuations in the subassembly. Experimental arrangements, results of investigations, and instrumentation of the subassembly mock-up are described in detail. Author (NSA)

N71-38219# Atomic Energy Establishment, Winfrith (England).
REACTOR PHYSICS CHARACTERISTICS OF THE HIGH TEMPERATURE REACTOR
J. G. Tyror Mar. 1971 9 p Presented at Am. Nucl. Soc. Meeting, Los Angeles
(AEEW-M-985; Conf-700808-37) Avail: AEC Depository Libraries

A brief description is given of the physics aspects of the UK high-temperature gas-cooled reactor, together with details of first phase physics experiments including resonance capture measurements in U-238 in a typical HTR lattice. Results of these measurements are summarized. NSA

N71-38220# Atomic Energy of Canada, Ltd., Chalk River (Ontario). Nuclear Labs.
PERFORMANCE OF UNIAXIAL CREEP MACHINES IN THE NRX AND NRU REACTORS
P. F. Anderson Feb. 1971 71 p refs
(AECL-3738) Avail: AEC Depository Libraries; Atomic Energy of Can., Ltd., Chalk River: $2.00

The Mk-4 and Mk-6 machines were in use in NRX and NRU. A number of disposable machines were built, resulting in the Mk-10 design which may be used in either reactor. Control equipment was automated, and data retrieval computerized. The original and redesigned equipment is described, with details of its operational reliability. Author (NSA)

N71-38221# European Atomic Energy Community, Ispra (Italy). Joint Nuclear Research Center.
MECHANICAL BEHAVIOUR OF COMPLEX STRUCTURES IN PRESENCE OF CREEP, THERMAL STRAINS AND IRRADIATION-INDUCED DIMENSIONAL CHANGES [COMPORTEMENT MECHANIQUE DE STRUCTURES COMPLEXES EN PRESENCE DE FLUAGE, D'UN CHAMP DE TEMPERATURE ET DE VARIATIONS DE DIMENSION DUES A L'IRRADIATION]
J. Donea and S. Giuliani 10 Dec. 1970 66 p refs In FRENCH
(EUR-4629-F; EUR-FF-945) Avail: AEC Depository Libraries

A numerical method of analysis and the associated computer program are presented for the determination of stresses and strains in complex structures encountered in the field of the nuclear technology. The method is based on the finite element technique. Plane stress, plane strain, and axisymmetric situations can be investigated. Material anisotropy, general creep laws, thermal strains as well as irradiation induced dimensional changes can be taken into account. Numerical examples are presented to demonstrate the validity of the proposed method of analysis. Author (NSA)

N71-38222# Central Electricity Generating Board, Berkeley (England). Berkeley Nuclear Labs.
INTERFACIAL PHENOMENA IN LIQUID METAL COOLED REACTOR SYSTEMS
H. E. Evans and W. R. Watson Feb. 1971 27 p refs
(RD/B/N-1721) Avail: AEC Depository Libraries

A survey is presented of interfacial effects on mass transfer and other processes in liquid metal cooled fast reactors. Topics discussed include surface energy, wetting behavior, adsorption at liquid and solid surfaces, and the development of contact potentials at interfaces between dissimilar materials. The relevance of these topics to mass transfer and other processes in a LMFBR under routine and fault conditions is discussed. Author (NSA)

N71-38223# Centre d'Etude de l'Energie Nucleaire, Mol (Belgium).
FAST BREEDER FUEL PROCESSING PYROCHEMICAL HEAD END STUDY
J. G. Wurm, C. David, P. R. Heylen, R. D. De Beukeleer, and A. De Coninck 27 Jul. 1970 24 p refs Presented at the European Meeting of Chem. Eng., Frankfurt am Main, 17-24 Jun. 1970
(EUR-4615-E; Conf-700651-1) Avail: AEC Depository Libraries

Conceptual head end studies were made for highly irradiated fast breeder fuel. The storage of short cooled fuels in a hybrid sodium organic coolant storage pool and decladding experiments based on the Sb-Cu liquid metal dissolution technique are considered. A general design and layout of the hybrid Na organic storage pool is given and the inherent advantages over other storage facilities are discussed. The presence of Na during the liquid metal dissolution procedure was investigated and it was shown on the basis of a small pilot scale experiment that sodium does not present a problem at this stage. Small scale liquid metal dissolution experiments combined with filtration performed on small dummy fuel elements (19 pins) filled with ceramic proved the feasibility of the process. Author (NSA)

N71-38224# Societe Belge pour l'Industrie Nucleaire, Brussels (Belgium).
PYROCHEMICAL HEAD END CONCEPTION FOR FAST BREEDER FUEL PROCESSING
J. G. Wurm, P. R. Heylen, R. C. De Beukeleer, and A. De Coninck 6 Jul. 1970 20 p refs Presented at the Reactor

Meeting, Berlin, 20 Apr. 1970
(EUR-4614-E; Conf-700438-1) Avail: AEC Depository Libraries

An integrated pyrochemical head end was developed. It is based on the decladding of the stainless steel canning in a liquid solvent alloy composed of Sb-Cu and followed by a disaggregation of the fuel in a molten oxidizing salt bath composed of alkaline nitrates. Two different Sb-Cu dissolution procedures are described and a materials balance is given for the liquid metal dissolution as well as for the molten salt disaggregation. Author (NSA)

N71-38225# Central Electricity Generating Board, Berkeley (England). Nuclear Labs.
THE EFFECT OF THE CONDITION OF THE EXTERNAL SURFACE ON THE FRACTURE STRENGTH OF HTR FUEL COMPACTS
M. O. Tucker Jan. 1971 30 p
(RD/B/N-1839; RPC(GP)/P-(70)46) Avail: AEC Depository Libraries

With the use of existing linear elastic models, theoretical confirmation is given to the proposition that removal of the crack-free layer on the surface of an HTR fuel compact causes a reduction of approximately 30% in its fracture strength. The mechanism responsible for this effect is identified as the enhanced interaction between the compact surface and the circumferential cracks in the graphite matrix adjacent to the coated UO2 fuel particles. The effect of the thickness of the crack-free surface layer on the fracture strength of the compact is also estimated. Author (NSA)

N71-38226# United Kingdom Atomic Energy Authority, Harwell (England).
A CAPSULE RIG FOR IRRADIATION OF STRUCTURAL MATERIALS IN THE SM-2 REACTOR WITH TEMPERATURE CONTROL
G. P. Lobenov et al May 1970 17 p refs Transl. into ENGLISH from the Russian report SRARI-P-10 Presented at the Joint UK/USSR Seminar on the Operation and Use of Res. and Testing Reactors, Harwell, England, Oct. 1969
(LB/G-3025; CONF-691060-11; SRARI-P-10) Avail: AEC Depository Libraries

A capsule rig has been developed for the irradiation of structural materials in the SM-2 Reactor (Russia) in-pile loops over a wide range of specimen irradiation temperatures. During an experiment, it is possible to effect control of specimen temperatures by changing the coolant flow through the rig. The maximum range of temperature control is approximately 150 C. Design parameters for the capsule rig are presented.
Author (NSA)

N71-38227# United Kingdom Atomic Energy Authority, Harwell (England). Information Branch.
DETERMINATION OF SOME PHYSICAL PROPERTIES OF LOOPS AND EXPERIMENT HOLES IN THE MR REACTOR
L. A. Goncharov et al Apr. 1970 29 p refs Transl. into ENGLISH of Inst. At. Energii, Moscow, IAE-1922 Presented at Joint UK/USSR Seminar on the Operation and Use of Res. and Testing Reactors, Harwell, Engl., Oct.-Nov. 1969
(LB/G-3010; Conf-691060-8; IAE-1922) Avail: AEC Depository Libraries

Several methods of determining the neutron properties of loops containing fuel assemblies and of positions for irradiating structural materials in the MR reactor are described. Data are given concerning the influence of various factors on the absolute value and distribution of thermal and fast fluxes and on the nonuniformity of heat generation in a number of loops containing fuel assemblies under test. Methods are discussed for flattening the neutron distributions in the loops and reducing the nonuniformity of heat generation in the test assemblies.
Author (NSA)

N71-38228# United Kingdom Atomic Energy Authority, Harwell (England). Information Branch.
ORGANISATION AND PLANNING OF EXPERIMENTS IN A RESEARCH REACTOR
V. A. Tsykanov et al Dec. 1969 21 p refs Transl. into ENGLISH of Nauchn.-Issled. Inst. At. Reactorov, Melekess, USSR, report Presented at Joint UK/USSR Seminar on the Operation and Use of Res. and Testing Reactors, Harwell, Engl., Oct.-Nov. 1970
(LB/G-3011; Conf-691060-19) Avail: AEC Depository Libraries

Methods for determining the optimum utilization of research reactor experimental facilities are presented. Irradiation programs for the SM-2 Reactor (Russia) are analyzed. NSA

N71-38229# United Kingdom Atomic Energy Authority, Harwell (England). Information Branch.
A CAPSULE RIG FOR THE IRRADIATION OF STRUCTURAL MATERIALS IN THE SM-2 REACTOR WITH TEMPERATURE CONTROL BY VARIATION OF GAS-GAP SIZE
G. P. Lobavov et al Mar. 1970 16 p refs Transl. into ENGLISH of Nauchn.-Issled. Inst. At. Reactorov, Melekess, USSR, report SRARI-P-56 Presented at Joint UK/USSR Seminar on the Operation and Use of Res. and Testing Reactors, Harwell, Engl., Oct.-Nov. 1969
(LB/G-3013; Conf-691060-17; SRARI-P-56) Avail: AEC Depository Libraries

The construction description and principal capsule channel characteristics used for the construction materials irradiation under an elevated temperature in SM-2 reactor are given. The channel construction permits a temperature adjustment of specimens during irradiation by varying the thermal resistance value (the helium gap thickness) between specimens in which heat is generated, and by the reactor coolant removing this heat from the capsule channel body. Author (NSA)

N71-38230# United Kingdom Atomic Energy Authority, Harwell (England). Information Branch.
DETERMINATION OF INTEGRATED NEUTRON FLUXES DURING IRRADIATION OF MATERIALS IN RESEARCH REACTORS
B. A. Zaletnyth et al Dec. 1969 9 p refs Transl. into ENGLISH of Nauchn.-Issled. Inst. At. Reactorov, Melekess, USSR, report Presented at Joint UK/USSR Seminar on the Operation and Use of Res. and Testing Reactors, Harwell, Engl., Oct.-Nov. 1969
(LB/G-3014; Conf-691060-24) Avail: AEC Depository Libraries

A program at the SM-2 and MIR reactors to determine conditions of irradiation of materials and fuel elements in the experimental facilities is described. In the SM-2 reactor, which is mainly intended for materials studies, neutron fluxes and spectra in empty holes have been measured; then a physical model of the reactor is used to measure the perturbation caused by any particular loading of the experiment hole. From this information the integrated fluxes during irradiation are determined. In the MIR reactor, which is intended for fuel assembly loop tests, it is more important to know the distribution of energy evolution in the loop cells. This distribution is measured using a physical model of the reactor. Information about the neutron spectra can be calculated and integrated fluxes determined from the energy evolution. Author (NSA)

N71-38231# United Kingdom Atomic Energy Authority, Harwell (England). Information Branch.
POWER CONTROL FOR LOOP ASSEMBLIES IN THE MIR REACTOR
V. A. Tsykanov et al Dec. 1969 11 p ref Transl. into ENGLISH from Russian report Presented at the Joint UK/USSR Seminar on the Operation and Use of Res. and Testing Reactors, Harwell, England, Oct. 1969
(LB/G-3015; Conf-691060-20) Avail: AEC Depository Libraries

On the basis of information obtained in the study of characteristics and operation of the MIR loop reactor, it is found to be necessary to control the energy evolution in each loop channel seperately in order to deal with one of the basic problems of a multi-loop research reactor: the simultaneous establishment and maintenance during the run of the necessary

conditions in all the loop channels which are placed in the reactor. The means of control used for this purpose must provide both the initial adustment of conditions and also correction of the energy distribution in the core during the run in order to maintain this adjustment. The possibilities of such means of control of loops are described as regular reactor control rods, absorbing screens both continuous and in the form of rods placed around the loop channel, variation of the composition of the medium in the loop cell and variation of the fuel charge in the channels surrounding the loop channel. Author (NSA)

N71-38232# United Kingdom Atomic Energy Authority, Harwell (England). Information Branch.
EXPERIMENTAL DETERMINATION OF NUCLEAR HEATING VALUES IN SM-2 REACTOR HOLES
V. A. Neverov et al Jan. 1970 38 p refs Transl. into ENGLISH from Russian report Presented at the Joint UK/USSR Seminar on the Operation and Use of Res. and Testing Reactors, Harwell, England, Oct. 1969
(LB/G-3016; SRARI-P-37; Conf-691060-13) Avail: AEC Depository Libraries

The results of measurements are analyzed to provide the most probable nuclear heating values caused by absorption of radiation energy by samples of materials placed in experiment holes of the reactor. Possible fluctuations of heating values in these holes have been investigated, leading to some recommendations for the elimination of particular causes of instability. Distributions of nuclear heating along the vertical hole 8 and the horizontal hole 4 are also given. These may be regarded as typical. Author (NSA)

N71-38233# United Kingdom Atomic Energy Authority, Harwell (England). Information Branch.
DEVELOPMENT OF METHODS AND RECORDERS FOR EXPERIMENTAL DETERMINATION OF NUCLEAR HEATING IN HIGH-FLUX RESEARCH REACTOR HOLES
V. A. Neverov et al Mar. 1970 89 p refs Transl. into ENGLISH from Russian report Presented at the Joint UK/USSR Seminar on the Operation and Use of Res. and Testing Reactors, Harwell, England, Oct. 1969
(LB/G-3017; SRARI-P-19; Conf-691060-14) Avail: AEC Depository Libraries

A description is given of the design of a new calorimetric apparatus and recording system for following the time variation of sample temperature and reactor power. The previously known and newly developed calorimetric methods of measuring heat generation in reactor holes are analyzed. A more precise estimate of the errors of measurement in a number of methods is obtained from heat-generation measurements in several SM-2 reactor holes with a single calorimetric apparatus and various methods applied simultaneously. Results are given of a measurement of nuclear heating in reactor holes at various times after the shutdown rods have been dropped. Author (NSA)

N71-38234# United Kingdom Atomic Energy Authority, Harwell (England). Institut Atomnoi Energii.
EXPERIENCE IN THE OPERATION AND USE OF THE IRT-M REACTOR AT THE I. V. KURCHATOV INSTITUTE
V. N. Chernyshevich May 1970 28 p refs Presented at the Joint UK/USSR Seminar on the Operation and Use of Res. and Testing Reactors, Harwell, England
(LB/G-3009; IAE-1921) Avail: AEC Depository Libraries

Experimental facilities in the modernized IRT-M reactor are described. An example is given of the use of the reactor for capsule experiments (in the core). The main operating characteristics of the reactor are listed and also the results of measuring the temperature of the fuel-element wall during normal operation and on emergency shutdown of the primary-circuit circulating pumps. Author (NSA)

N71-38235# Physikalisch-Technische Bundesanstalt, Brunswick (West Germany).
EXPERIENCE REPORT ON THE OPERATION AND RADIATION PROTECTION AT THE BRAUNSCHWEIG RESEARCH AND MEASUREMENT REACTOR, 1970 [ERFAHRUNGSBERICHT UEBER DEN BETRIEB UND DEN STRAHLENSCHUTZ DES FORSCHUNGS- AND MESSREATKTORS BRAUNSCHWEIG (FMRB), 1970]
W. Heintz and V. Siegel Feb. 1971 35 p refs In GERMAN; ENGLISH summary
(FMRB-35/71) Avail: AEC Depository Libraries

The experience in the operation of FMRB and in radiation protection work is reported for the year 1970. No serious problems arose, the generated energy amounted to 1300 MWh. Author (NSA)

N71-38236# Atomic Energy Establishment, Cairo (Egypt). Reactor and Neutron Physics Dept.
THERMAL FLUX DISTRIBUTION AND REFLECTOR SAVING MEASUREMENTS IN UA-RR-1 REACTOR CORE
M. G. Sabek, A. I. El-Cherif, and S. F. Nassar 1970 10 p refs
(UARAEE-99) Avail: AEC Depository Libraries

The thermal neutron flux distribution along the axial direction of the UA-RR-1 reactor core was measured by the foil activation technique. The experiment was carried out in two positions of the reactor core where the effect of the control rod was at a minimum. The asymptotic region of the flux distribution was determined by constant cadmium ratio and a least squares fitting to a cosine function was conducted. The fit gave a value of (7.22 + or - 0.16) cm for the axial reflector saving. It was impossible to measure the radial reflector saving because of the rigid structure of the core. The value of the axial reflector saving is in good agreement with the theoretical value. Author (NSA)

N71-38237*# United Aircraft Corp., East Hartford, Conn. Research Labs.
EFFECT OF 1.5 MeV ELECTRON IRRADIATION ON THE TRANSMISSION OF OPTICAL MATERIALS Interim Summary Technical Report, 16 Sep. 1970 - 15 Sep. 1971
Gary E. Palma and Ronald M. Gagosz Sep. 1971 49 p refs
(Contract SNPC-70)
(NASA-CR-123187; ITR-2; K-990929-2) Avail: NTIS CSCL 18F

A program of experiments was conducted to measure the optical transmission of several transparent materials before, during, and immediately after 1.5 MeV electron irradiation. A comparison was made of irradiation-induced optical absorption in three commercial grades of high-purity fused silica. It was found that the behavior of Corning 7940, Amersil, and Spectrosil high-purity grades of fused silica were similar with regard to the generation, annealing, and optical bleaching of the irradiation-induced optical absorption in the wavelength interval 2000 to 3000 A. In addition, measurements of the optical transmission of single crystal specimens of aluminum oxide, magnesium fluoride, barium fluoride, lithium fluoride, and beryllium oxide were made during 1.5 MeV electron irradiation in the wavelength interval of 2000 to 3000 A. Author

N71-38238*# United Aircraft Corp., East Hartford, Conn. Research Labs.
ANALYTICAL STUDIES OF NUCLEAR LIGHT BULB ENGINE RADIANT HEAT TRANSFER AND PERFORMANCE CHARACTERISTICS
Richard J. Rodgers, Thomas S. Latham, and Harold E. Bauer Sep. 1971 126 p refs
(Contract SNPC-70)
(NASA-CR-123189; K-910900-10) Avail: NTIS CSCL 21F

A description is given of nuclear light bulb engine characteristics including engine performance, dynamics and control, heat loads, and shutdown. Design modifications to improve accessibility and reusability are also included. An analytical model for engine radiant heat transfer is outlined and analysis results are discussed. J.M.

N71-38239*# United Aircraft Corp., East Hartford, Conn. Research Labs.
EXPERIMENTS TO SIMULATE HEATING OF THE

PROPELLANT IN A NUCLEAR LIGHT BULB ENGINE USING THERMAL RADIATION FROM A D-C ARC RADIANT ENERGY SOURCE Interim Summary Technical Report, 16 Sep. 1970 - 15 Sep. 1971
John F. Klein Sep. 1971 71 p refs
(Contract SNPC-70)
(NASA-CR-123199; ITR-2; K-910900-8) Avail: NTIS CSCL 18I

Experiments were conducted to simulate radiant heating of the propellant stream of a nuclear light bulb engine. A 500 kW dc arc was used as the radiant energy source and argon seeded with carbon particles was used to simulate the propellant. Unseeded buffer layers were used to prevent coating of the transparent duct walls. Methods were developed for introducing micro-sized carbon seeds into the central region of a three-stream flow in a rectangular duct to simulate a portion of the propellant stream. Simulated propellant bulk exit temperatures up to 3960 K were achieved. The bulk exit temperatures were determined by a calorimetric technique. The maximum bulk exit temperatures were limited primarily by vaporization of the carbon seeds and the amount of radiation incident on the test section. It is estimated that substantially higher propellant bulk exit exit temperatures can be obtained by improvements to the dc arc radiant energy source (in particular, improvement of the reflectivity of the mirrors used) and by the use of tungsten seeds which will remain in particle form to higher temperatures than carbon seeds. Author

N71-38240*# United Aircraft Corp., East Hartford, Conn. Research Labs.
EXPERIMENTAL INVESTIGATIONS TO SIMULATE THE THERMAL ENVIRONMENT AND FUEL REGION IN NUCLEAR LIGHT BULB REACTORS USING AN R-F RADIANT ENERGY SOURCE Interim Summary Technical Report, 16 Sep. 1970 - 15 Sep. 1971
Ward C. Romen and Jerome F. Jaminet Sep. 1971 99 p refs
(Contract SNPC-70)
(NASA-CR-123192; ITR-2; K-910900-7) Avail: NTIS CSCL 18I

A description is given of the equipment and procedures utilized in radiant energy source, simulated fuel injection, transparent-wall model, and filament-wound pressure vessel studies. The RF induction heater simulation of the thermal environment and fuel region in nuclear light bulb type reactors is discussed including the testing of internally cooled transparent walls in a high-radiant-energy flux environment. The steady state power, chamber pressure, and radiation efficiency results for RF tests of a 2/3-scale version of a possible in-reactor unit cell configuration are reported as well as power and chamber pressure results for models having peripheral walls constructed from thin-walled fused silica tubes. J.M.

N71-38241*# Aerojet-General Corp., Azusa, Calif. Power Systems Div.
DESIGN REVIEW OF PCS-G CONDENSER, P/N 288340-1, REDESIGNED FROM P/N 683043
E. S. Chalpin 17 Jul. 1970 48 p
(Contract NAS3-13458)
(NASA-CR-72946; AGC-TM-7996:70-629) Avail: NTIS CSCL 18N

A limited redesign of the condenser was undertaken to modify two existing condensers so that they would more closely comply with redefined requirements of the SNAP-8 system, and could used in the power conversion system (PCS-G) for the combined system test. The NaK and mercury inlet and outlet ports were redesigned for higher allowable interface loads. The NaK side of the condenser was redesigned for a lower pressure drop. A modification of the mercury inlet was made to obviate the need for a bellows as well as to incorporate an evacuation port for removing noncondensible gases from the Rankine loop. The existing design was also modified to incorporate the new method of attachment to the PCS. Author

N71-38242*# Aerojet-General Corp., Azusa, Calif. Power Systems Div.
OXIDES IN NaK
F. H. Cassidy 6 Feb. 1970 24 p refs
(Contract NAS5-417)
(NASA-CR-72963; AGC-TM-4923:70-614) Avail: NTIS CSCL 18N

A review was made of how the eutetic alloy of NaK and the SNAP-8 system are affected by oxygen reactivity; the sources of oxygen contamination in a NaK system; the solubility of the oxide; the effects of the oxide in respect to the system and on the NaK; and oxide control methods. Author

N71-38243*# Aerojet-General Corp., Azusa, Calif. Power Systems Div.
EVALUATION OF SNAP-8 BARE REFRACTORY DOUBLE CONTAINMENT BOILER NO. 2 AFTER 8700 HOURS OF OPERATION
H. E. Stoll 25 Aug. 1970 52 p refs
(Contract NAS3-13458)
(NASA-CR-72962; AGC-TM-7972:70-640) Avail: NTIS CSCL 18N

The Hg inlet and outlet, and one tantalum tube from the SNAP-8 bare refractory double containment boiler No. 2 were metallurgically evaluated after 8700 hours of operation. With the correction of some deficiencies, a five-year operational life for boilers of this type is attainable. Inherent corrosive or erosive attack of the construction materials by the NaK or the mercury was not detected. The materials used in this boiler are suitable for future boiler fabrication. Minor surface defects in the tantalum, produced during fabrication, exhibited no tendency to initiate failure. The deficiencies in the boiler can be eliminated by design, fabrication or procedural modifications. A decreased boiler pressure drop which occurred with increased operating time was attributed to organic contamination of the I.D. of the Ta tubes. Modifications of system operational procedures can eliminate or minimize this condition. For optimum low cycle fatigue life, welding techniques to produce finer grained Ta weldments should be developed. Author

N71-38244*# Aerojet-General Corp., Azusa, Calif. Power Systems Div.
OPERATION AND POST-TEST INSPECTION OF THE SNAP-8 PRE-PROTOTYPE BOILER P/N CF 781840, S/N 2
E. S. Chalpin and G. L. Lombard 24 Feb. 1970 58 p refs
(Contract NAS3-13458)
(NASA-CR-72960; AGC-TM-4967:70-616) Avail: NTIS CSCL 18N

The boiler, designed and built by NASA-LeRC, was tested for 8700 hours and 27 startups. During this period, a bellows used for stainless steel-to-tantalum differential expansion failed. The primary NaK loop shell failed twice and a static NaK stainless steel tube cracked in the same area as the primary NaK shell failures. Diminution of mercury side pressure drop during operation was attributed to mercury loop contamination, not boiler design. Tantalum used for mercury containment was shown to be an ideal material metallurgically. With some design modifications, it appears that this boiler could meet the specification requirement of 10,000 hours of operation with 100 startups. Author

N71-38245*# Aerojet-General Corp., Azusa, Calif. Power Systems Div.
EVALUATION OF SNAP-8 LIQUID NaK PUMP-MOTOR (NaK PMA) FOLLOWING VIBRATION AND SHOCK TESTING
R. S. Nelson 10 Dec. 1970 48 p
(Contract NAS3-13458)
(NASA-CR-72926; AGC-TM-7978:70-636) Avail: NTIS CSCL 18N

The NaK PMA, buildup 2/7, using a Mod 1 motor, was subjected to the environmental conditions expected for flight hardware. The PMA was filled with a kerosene-type oil, to simulate NaK during the test. Evaluation of the components after disassembly revealed some damage to the thrust bearing and an intermittent ground in the motor windings. Preenvironmental and

postenvironmental hydraulic performance tests in a water test loop showed that no appreciable change in performance had occurred. The stator housing was systematically disassembled which resulted in the discovery of the location of the grounding condition. A design change insulating the area of the ground incorporated on Mod 2 motors eliminates the need for further changes. Some minor changes to the thrust bearing gimbal sockets and locking pins are necessary, however, to assure the PMA passing the rigors of vibration and shock testing. Author

N71-38246*# Aerojet-General Corp., Azusa, Calif. Power Systems Div.
PCS-G SYSTEMS ANALYSIS Status Report
L. R. Favero 12 Nov. 1969 57 p
(Contract NAS5-417)
(NASA-CR-72915; AGC-TM-4942:69-601) Avail: NTIS CSCL 18N

The results to date of the continuing systems analysis on PCS-G (power conversion system) are presented. The STRAP-3 (SNAP-8 transient analysis program) computer code was used to simulate PCS-G startup and shutdown. A low pressure mercury injection system is described which uses the differential pressure across the lubrication and coolant pump as a source of hydraulic power to operate the diaphragm of a mercury reservoir. Two groups of computer test runs were made. The first group of runs consisted of startup runs commencing with preinjection component and system conditions which represented the worst which could reasonably exist in operational use. The conditions were altered to stress various system parameters on the theory that a system which can start up satisfactorily under the worst conceivable conditions would be suitable for the actual conditions encountered in operational use. The study shows that the system as designed, using the pretest reactor temperature coefficients, while previously satisfactory, is now only partially satisfactory using AI supplied post-test reactor coefficients. Author

N71-38247*# Aerojet-General Corp., Azusa, Calif.
DESIGN REVIEW OF THE BARE REFRACTORY DOUBLE-CONTAINMENT (BRDC) BOILER NUMBER 5 FOR PCS, SNAP-8
E. S. Chalpin 22 Oct. 1970 303 p refs
(Contract NAS3-13458)
(NASA-CR-72918; AGC-TM-7978:70-643) Avail: NTIS HC $6.00/MF $0.95 CSCL 18N

The design of the BRDC boiler no. 5 is presented. THe boiler meets all defined interfaces and requirements of the power conversion system. Tantalum is used as the mercury containment material and type 300 stainless steels are used as the NaK containment material. Zirconium is employed at the mercury inlet and outlet sections as a gettering material for the dissolved gases in the static Nak and to minimize carbon transport from the type 300 stainless steel to the tantalum by gettering carbon. Coextruded tantalum-to-stainless steel transition joints (bimetal tubes) are used at the mercury inlet and outlet. Author

N71-38248*# Aerojet-General Corp., Azusa, Calif.
EVALUATION OF SNAP-8 ALTERNATOR P/N 694069, S/N 481490 AFTER 23130 HOURS OF ENDURANCE TESTING IN THE ELECTRICAL COMPONENT TEST FACILITY (ECTF)
R. S. Foley 9 Jun. 1970 128 p refs
(Contract NAS3-13458)
(NASA-CR-72920; AGC-TM-3710:71-650) Avail: NTIS CSCL 18N

An alternator was used for endurance testing simultaneously with a drive adapter consisting of a housing, shaft, bearings, and other parts. This arrangement made a simple coupling between the gearbox drive and the alternator and enabled endurance tests to be conducted on the turbine bearings as well as on the alternator. The testing arrangement is shown. Testing was done to determine if there were any weaknesses in the alternator and other electrical components which would show up under long term testing. The alternator and drive adapter were examined after endurance testing to evaluate the causes for test termination. Author

N71-38249*# Aerojet-General Corp., Azusa, Calif. Power Systems Div.
SNAP-8 ELECTRICAL PROTECTIVE SYSTEM MODULE DESIGN REVIEW
N. E. Waldschmidt 8 Apr. 1970 188 p
(Contract NAS3-13458)
(NASA-CR-72938; AGC-TM-7997:70-607) Avail: NTIS CSCL 18N

A design review of the Electrical Protective System Module (EPSM) is presented featuring three single-phase undervoltage overvoltageoverspeed sensing circuits and the elimination of a elimination of a separate overspeed circuit. This design also features a two-out-of-three logic network in the output of the EPSM to prevent false shutdown signals from being generated in case of a failure of any one of the three separate single-phase circuits. Included are the backup data and analyses upon which this design is based. A set of fabrication and assembly drawings was prepared and forms a part of the permanent design file of the EPSM. E.M.C.

N71-38250*# Aerojet-General Corp., Azusa, Calif. Power Systems Div.
MOD-C PROGRAM, TURBINE VISCO SEAL CAVITATION TESTS
M. G. Cherry Mar. 1970 114 p refs
(Contract NAS3-13458)
(NASA-CR-72939; AGC-TM-4932:70-604) Avail: NTIS CSCL 18N

For the purpose of developing dynamic seal-to-space systems for the SNAP-8 turbine, three rigs were tested which incorporated different space seal designs. One of these designs, which simulated the current seal design, exhibited a much accelerated rate of cavitation damage when compared to actual turbine operation. However, no mercury leakage occurred, thereby extending the seal life, extrapolated to actual turbine conditions, to 60,000 and 70,000 hours. One of the other two designs demonstrated almost negligible cavitation damage, with no evidence of leakage, leading to the prediction of an even more extended life. The third design showed only slight damage and no leakage, but operational difficulties indicated that much more development would be needed in this latter case. Author

N71-38251*# Aerojet-General Corp., Azusa, Calif. Power Systems Div.
MECHANICAL EVALUATION OF TAA 5/4 AFTER 10,823 HOURS OF OPERATION IN PCS-1
M. G. Cherry 15 Oct. 1970 116 p refs
(Contract NAS3-13458)
(NASA-CR-72921; AGC-TM-7977:70-617) Avail: NTIS CSCL 18N

The SNAP-8 Turbine Alternator Assembly, Buildup 5/4, was operated during PCS-1, Phase 4, Step 3 tests for 10,823 hours between 4 July 1967 and 22 September 1969. The unit was disassembled, inspected, and reassembled only once at 2122 hours of operation. Erosion was distinctly evident on the second and third stage rotor blade leading edges, barely discernible erosion was indicated on the other stages. Some mass transfer buildup was observed in the third stage nozzle. The rotating assemblies of turbine and alternator were in very good condition. The bearings in both assemblies were in excellent condition showing only slight blemishes. Minute cracks previously observed in the first stage nozzle assembly had propagated. The mechanical integrity of the part was not endangered. Continued cavitation damage on the visco ring was also observed. None of the damage subetained was considered to preclude reassembly and continued operation for a further 10,000 hours. Author

N71-38252*# Aerojet-General Corp., Azusa, Calif.
PRELIMINARY DESIGN OF MK 70 REACTION TURBINE FOR SNAP-8 90 kWe SYSTEM
W. Waters 27 May 1971 276 p refs
(Contract NAS3-13468)
(NASA-CR-72919; AGC-TM-3710:71-651) Avail: NTIS CSCL 18N

The preliminary design for the reaction turbine was completed. A turbine configuration was selected which will yield a minimum turbine efficiency of 76% (total to static). Two configurations were found to be satisfactory. Both used dual and opposed turbine assemblies mounted on the same shaft. This introduced the total system flow at the center of the turbine assembly and allowed half to flow away from the inlet manifold through each of the two assemblies. Thus the net axial loads from stage reaction were effectively cancelled. The recommended turbine configuration employs a single radial inflow impeller to replace the two initial stages of each half of an axial flow turbine. The symmetrical impeller accepts total system flow at the inlet, but within the impeller, the flow is halved with each half discharging axially in opposite directions to continue expansion through axial flow stages. A bearing life of at least five years can be expected. Author

N71-38253*# Aerojet-General Corp., Azusa, Calif. Power Systems Div.
SNAP-8 POWER FACTOR CORRECTION ASSEMBLY
R. M. Hill 29 Jul. 1969 168 p
(Contracts NAS5-417; NAS3-13468)
(NASA-CR-72936; AGC-TM-4936:69-568; AGC-TM-4968:70-618) Avail: NTIS CSCL 18N

Background data on the reasons for using capacitors, their selection and design, and data relating to the complete package design is presented. Two technical reviews and a major design review were held, with packaging design changes incorporated into the drawings. The revised design of a prototype power factor correction assembly was completed and the final drawings were released. A stress analysis of the current design was performed. The analysis indicates satisfactory design margins for all the structural components. Thermal analysis indicates the temperature rise within the capacitors is small compared to the maximum temperature capability of the parts. Data related to the heat sink temperature and fuse wire temperature calculations is also presented. The design for the correction assembly was reviewed and approved. The reviews and analysis performed show that the design will meet the specification requirements outlined. Author

N71-38254# Hanford Engineering Development Lab., Richland, Wash.
IRRADIATION EFFECTS ON REACTOR STRUCTURAL MATERIALS Quarterly Progress Report, Nov. 1970 - Jan. 1971
T. T. Claudson, ed. Mar. 1971 353 p refs
(Contract AT(45-1)-2170)
(HEDL-TME-71-43) Avail: NTIS HC $6.00/MF $0.95

Research and development on irradiation damage in materials is summarized. Results of testing at Atomics International, Argonne National Laboratory, Battelle Memorial Institute, General Electric Company, Hanford Engineering Development Laboratory, Idaho Nuclear Corporation, Naval Research Laboratory, Oak Ridge National Laboratory, and Pacific Northwest Laboratory are reported. NSA

N71-38255# Oak Ridge National Lab., Tenn.
MEASUREMENT AND CORRELATION OF THERMAL RESISTANCE OF UN-METAL INTERFACES
R. K. Williams, T. E. Banks, and D. L. McElroy May 1971 54 p refs
(Contract W-7405-eng-26)
(ORNL-4660) Avail: NTIS

Data were obtained on thermal contact resistance for contact interfaces between UN and several other metals in vacuum at about 50 C: UN-In, UN-type 1100 Al, UN-Cu, UN-V-15% Cr-5% Ti, UN-Mo, UN-UN, and three UN-type 302 stainless steel interfaces. Many variables affected the results, and the correlation of the data showed the relative importance of stress, hardness, thermal conductivity, and surface topography. The correlation obtained from the data also suggests means for reducing thermal contact resistance in fuel elements; these possibilities are discussed. Author (NSA)

N71-38256# California Univ., Livermore. Lawrence Radiation Lab.
ENGINEERING AND ECONOMIC ASPECTS OF MIRROR MACHINE REACTORS WITH DIRECT CONVERSION
R. W. Werner, G. A. Carlson, J. D. Lee, R. W. Moir, R. F. Post et al 20 May 1971 27 p refs Presented at 4th Conf. on Plasma Phys. and Controlled Nucl. Fusion Res., Madison, Wis., 17-23 Jun. 1971 Sponsored by AEC
(Conf-710607-127; CN-28/K-2; UCRL-72883) Avail: NTIS

Designs considered include Yin-Yang and axially symmetric coil configurations, DT and D3He fuel cycles, and net electrical outputs ranging from 100 to 1000 MW, the latter being the base case. The operating power level of each reactor component is determined as a function of component efficiencies, Q (defined as the ratio of fusion power to trapped injected power), and other relevant variables. The results indicate that the DT system with direct conversion is economically attractive for expected Q values and component efficiencies. In comparison, the D3He system is characterized by high sensitivity to system changes at expected Q values, and very high component efficiencies are required in order to make it economical. The disadvantage of the DT system is that it is basically a heat engine and has little potential for overall system efficiencies greater than 45% at blanket temperatures usually considered. In contrast, D3He has a potential for operating economically at system efficiencies greater than 80%. Author (NSA)

N71-38257# Oak Ridge National Lab., Tenn.
EMERGENCY COOLING AND RADIOACTIVE WASTE-DISPOSAL REQUIREMENTS FOR FUSION REACTORS
Don Steiner 17 Jun. 1971 22 p refs Presented at the 4th Conf. on Plasma Phys. and Controlled Nucl. Fusion Res., Madison, Wis., 17-23 Jun. 1971 Sponsored by AEC
(Conf-710607-134; CN-28/K-11) Avail: NTIS

The emergency cooling and radioactive waste-disposal requirements anticipated for fusion reactor are compared with those requirements posed by fission reactors. A reference fusion reactor is used as the basis for comparison. This reactor is based on the D-T fuel cycle and employs a blanket consisting of niobium as the structural material, lithium as the coolant, and graphite as the neutron moderator and reflector. Relative to fission reactors, the reference fusion reactor exhibits the following advantages with respect to emergency cooling requirements: (1) a lower hazard potential associated with radioactive inventories, (2) lower nuclear power densities during operation and for many hours following shutdown, (3) no potential for nuclear energy insertions resulting from loss of coolant or meltdown, and (4) a more favorable coolant-passage geometry. Of the several blanket structural materials considered, vanadium has the most desirable characteristics with regard to emergency cooling and radioactive waste disposal. Author (NSA)

N71-38258# Oak Ridge National Lab., Tenn.
ENGINEERING DESIGN STUDIES ON THE SUPERCONDUCTING MAGNET SYSTEM OF A TOKAMAK FUSION REACTOR
M. S. Lubell, W. F. Gauster, K. R. Efferson, A. P. Fraas, H. N. Long et al 17 Jun. 1971 17 p refs Presented at the 4th Conf. on Plasma Phys. and Controlled Nucl. Fusion Res., Madison, Wis., 17-23 Jun. 1971 Sponsored by AEC
(Conf-710607-133) Avail: NTIS

A detailed engineering study was made of a superconducting magnet system for a full-scale Tokamak fusion reactor. For

economic reasons, the main toroidal field must be produced by superconducting coils. Compound conductors with twisted, thin filaments and a sufficiently high copper-to-superconductor ratio to provide both static and dynamic stability were used. The design of the mechanical structure is based on detailed force and stress calculations. The net radial force on each of the 48 coils is 10,580 tons, requiring massive reinforcement of the bobbins. The cryogenic calculations consider all sources of heat loads, and, in the worst case, about 75% of the total loss is due to the nuclear radiation. The structural design takes into consideration the assembly as well as maintenance and repair difficulties arising from radiation damage and neutron activation. Detailed cost estimates were made. The kind of major technological research and development work necessary for optimized realistic designs is summarized. Author (NSA)

N71-38259# Hanford Engineering Development Lab., Richland, Wash.
ANALYSIS OF SWELLING DATA FOR STAINLESS STEEL BASED ON THE LINDHARD THEORY OF ENERGY PARTITION
D. G. Doran, R. L. Simons, and W. N. McElroy May 1971 16 p refs Presented at the Intern. Conf. on Radiation Induced Voids in Metals, Albany, 9-11 Jun. 1971
(Contract AT(45-1)-2170)
(HEDL-SA-159; Conf-710601-1) Avail: NTIS

As part of a study of the implications of a spectrally sensitive displacement model on the analysis of swelling data, a new displacement cross section was calculated for stainless steel based on the energy partition theory of Lindhard et al. Void volume data are being collected from several laboratories and the best possible spectrum and fluence values associated with each data point. These spectra are being used to calculate the fraction F of flux exceeding 0.1 MeV, the spectrally averaged gross displacement cross sections D, and mean neutron energies E. The relationships between D, E and F are presented for a wide range of EBR-2 spectra and for several other reactors. An example is given to illustrate the differences in predictions of void formation that may result from using different measures of exposure. The relation between helium production rate, another important spectrally dependent quantity, and displacement rate in EBR- spectra is presented. Author (NSA)

N71-38260# Argonne National Lab., Ill.
SODIUM TECHNOLOGY Quarterly Report, Oct. - Dec. 1970
G. M. Kesser, Comp. Mar. 1971 63 p refs
(Contract W-31-109-eng-38)
(ANL/ST-8) Avail: NTIS

Work in the national meter program was continued on instrumentation for on-line monitoring of oxygen, carbon, and hydrogen impurities in sodium. Methods of detecting leaks in steam generators were studied to establish a commercial capability for on-line meters. The management effort involved formulation of interim standard analytical and sampling methods and the establishment of sample interchange programs to test these methods. Work continued on the development of a method for detecting fuel-cladding failures by monitoring the Xe-135m daughter of I-135. Studies of the chemistry of sodium included investigation of the nature of nitrogen-bearing species and elucidation of phase relations in the sodium-rich corner of the Na-O-H ternary system. Work on the purification of sodium continued with construction of an apparatus for characterizing the impurity content of cold-trapped sodium. Studies of materials-coolant compatibility included investigation of the transport of carbon in sodium-steel systems and development of methods for determining activities of nonmetallic impurities in sodium by equilibration of metal specimens. Author (NSA)

N71-38261# Argonne National Lab., Ill. Materials Science Div.
PREPARATION OF REPLICAS FOR ELECTRON MICROSCOPY OF IRRADIATED CERAMIC FUELS
L. C. Michels and G. M. Dragel Apr. 1971 10 p refs
(Contract W-31-109-eng-38)
(ANL-7790) Avail: NTIS

A technique for preparing replicas of irradiated uranium-plutonium dioxide nuclear fuel is described. Metallographically polished and etched specimens can be replicated by using a combination of in-cell and out-of-cell procedures. In addition, a technique is described whereby preselected, small, accurately locatable areas can be fractured and replicated. This latter technique is useful in determining fission-gas-bubble distributions as a function of radial position in the irradiated fuel. This technique was successfully applied to metallographic specimens from experimental mixed-oxide fuel elements irradiated in EBR-2. Author (NSA)

N71-38262# Oak Ridge National Lab., Tenn.
ATMOSPHERIC CONTAMINATION OF URANIUM DIOXIDE POWDER
M. L. Smith and J. M. Leitnaker Jun. 1971 16 p refs
(Contract W-7405-eng-26)
(ORNL-4704) Avail: NTIS

Room-temperature contamination of UO2 powder during storage in air of varying moisture content for several hundred hours was studied. An initial rapid chemisorption of oxygen was followed by a slow and independent sorption of water and oxygen. Both the slow sorption rates are nonlinear in the logarithm of time. The effect of several oxidation and reduction cycles on the surface area of the UO2 powder was also studied. Heating the UO2 at 800 C decreased the surface area of the powder. Oxidation of the UO2 to U3O8 at 400 C and reduction back to UO2 at 500 to 700 C increased the surface area. Author (NSA)

N71-38263# Commissariat a l'Energie Atomique, Fontenay-Aux-Roses (France). Centre d'Etudes Nucleaires.
THE NATURAL CONVECTION IRRADIATION DEVICE ESTHER
Jacques Leclerc, Andre Lhermenier, Denis Feges, and Jean-Claude Lauthier Oct. 1970 39 p Transl. into ENGLISH from French report CEA-N-1348
(EURFNR-890) Avail: NTIS

In order to perform radiation experiments on fast reactor fuels, a device which was to be used in the Siloe and Osiris swimming pool reactors was designed and constructed. The Esther device is characterized by natural convection cooling. The temperature distribution is analogous to that in a reactor channel. The temperature is adjusted by a variable thermal barrier. The flux level is increased by moving towards the core. This device can dissipate between 800 and 900 W/cm. Its main interest lies in the circulation of Na or NaK along the fuel element. Author (NSA)

N71-38264# International Atomic Energy Agency, Vienna (Austria).
INVESTIGATION OF REPROCESSING INPUT MEASUREMENT USING TRACER TECHNIQUE Final Report, 15 Dec. 1960 - 14 Jul. 1970
H. Bokelund Oct. 1970 30 p refs
(IAEA-R-876-F) Avail: AEC Depository Libraries

The basic concept is that of isotope dilution mass spectrometry applied to the dissolver solution into which, at the outset, a known amount of Li-7 was mixed as tracer. Samples of the solution are spiked with Li-6, U233, and Pu-242 for mass spectrometry. The measured ratio Li-6/Li-7 verifies the batch size (volume or weight), whereas the concentration ratios Pu/Li give the quantities of these fissile materials, (kg), in the batch. The solution of the Li-6 spike is calibrated against a dilution of the Li-7 solution used to trace the dissolver solution; the batch size can thus be found merely as a ratio of two Li-6/Li-7 ratios, thereby circumventing the complicated absolute standardization of the Li-7 additive. The assets of the lithium-concept are discussed in terms of process compatibility, analytical sensitivity, precision, and price. The chemical separation of Li from the dissolver solution prior to its determination by mass spectrometry

is described. Results on simulated input solutions show the capability of the system under laboratory conditions to be about 0.3% relative standard deviation. Author (NSA)

N71-38265# Central Electricity Generating Board, Berkeley (England). Nuclear Labs.
GRAIN BOUNDARY ENERGY OF IRRADIATED URANIUM DIOXIDE
G. L. Reynolds Mar. 1971 9 p refs
(RD/B/N-1851) Avail: AEC Depository Libraries

Specimens of irradiated UO2 were fractured and examined. Annealing for 72 hr at 1600 C showed no alteration in pore geometry. Observations were made on intergranular gas bubbles. The ratio of grain boundary energy to surface energy was obtained by considering the equilibrium between grain boundary and bubble interfaces. The values of the ratio obtained are between 1.8 and 1.6 with a median value of approximately 1.35. These high values are considered to be due to the contamination of the bubble surfaces by solid fission products. NSA

N71-38266# United Kingdom Atomic Energy Authority, Harwell (England).
ORGANISATION OF EXPERIMENTAL WORK ON FUEL-ELEMENT TESTING AT THE FIRST ATOMIC POWER STATION REACTOR
V. G. Konochkin et al Nov. 1969 23 p Transl. into ENGLISH from the Russian report Presented at the Joint UK/USSR Seminar on the Operation and Use of Res. and Testing Reactors, Harwell, Eng., Oct. - Nov. 1968
(Conf-691060-10; LB/G-3024) Avail: AEC Depository Libraries

Design modifications for the Obninsk power reactor to convert to a fuel testing reactor are described. Operations aspects of the modified reactor are analyzed. NSA

N71-38267# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Reaktorbauelemente.
RESEARCH AND DEVELOPMENT WORK CARRIED OUT IN THE KARLSRUHE NUCLEAR RESEARCH CENTER ON THE STEAM-COOLED FAST BREEDER [BERICHT UEBER DIE IM KERNFORSCHUNGSZENTRUM KARLSRUHE DURCHGEFUEHRTEN FORSCHUNGS- UND ENTWICKLUNGSARBEITEN ZUM DAMPFGEKUEHLTEN SCHNELLEN BRUETER]
P. Engelmann, F. Erbacher, G. Karsten, and L. Ritz Dec. 1970 167 p refs In GERMAN; ENGLISH summary
(KFK-1370) Avail: AEC Depository Libraries

In addition to a detailed documentation and a summary of individual results, work performed by industry is described. Based on the results described and by comparison with the situation encountered in the development of fast breeders with sodium and helium cooling, an evaluation of the situation is given and recommendations are provided for future action. Author (NSA)

N71-38268# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
CHARACTERISTICS OF FISSION PRODUCTS PRINCIPALLY IDENTIFIED IN FAST REACTORS IN VIEW OF DETECTING BURST SLUGS [CARACTERISTIQUES DES PRODUITS DE FISSION IDENTIFIES PRINCIPALEMENT DANS LES REACTEURS RAPIDES EN VUE DE L'APPLICATION A LA DETECTION DE RUPTURES DE GAINES]
Rene Denguy Mar. 1971 157 p In FRENCH
(CEA-Bib-195) Avail: AEC Depository Libraries

A bibliography consisting of chronological descriptions and divided into two parts is presented. The first part covers the period from October 1963 to February 1970 and relates to various documentation presented in the form of four classifications (reactors, measuring methods, products detected, and publications). The second part covers the period from January 1964 to January 1970 and is solely concerned with documents classified according to measuring methods and products detected. Author (NSA)

N71-38269# Oak Ridge National Lab., Tenn.
EXTENDED CONCEPTUAL STUDY OF DISASSEMBLY-REASSEMBLY EQUIPMENT FOR EXAMINATION OF FFTF CORE COMPONENTS AND TEST ASSEMBLIES
R. M. Beckers and W. W. Goolsby Jun. 1971 105 p refs Prepared for Battelle-Northwest, Richland, Wash.
(Contract W-7405-eng-26)
(ORNL-TM-3400) Avail: NTIS

The results of a supplemental extended conceptual study of the disassembly-reassembly equipment to be located in the interim examination and disassembly cell are reported. The extended study was performed to consider the effects of a reduction in the lengths of core components and test assemblies to be handled with the disassembly-reassembly equipment, addition of equipment capability for remote welding of girth joints in flow ducts of test assemblies, deletion of one set of disassembly equipment, and the deletion of performance testing of the equipment at Oak Ridge National Laboratory. The changes to the disassembly-reassembly equipment resulting from the criteria revisions are discussed, and the critical path time-cost schedule and cost estimate are updated to reflect the revisions. Assuming a start date of July 1971, the functionally tested equipment is scheduled for delivery to Richland 35 months later with completion of liaison work scheduled for May 31, 1975. Author (NSA)

N71-38270# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
MEASUREMENT OF THE TEMPERATURE DEPENDENCE OF k SUB INFINITY FOR A (U-233)O2-ThO HTGR LATTICE
E. P. Lippincott [1971] 10 p refs Presented at the 17th Ann. Meeting of the Am. Nucl. Soc., Boston, 13 Jun. 1971
(BNWL-SA-3756; Conf-710606-2) Avail: NTIS

The second in a series of experiments using the high temperature lattice test reactor has been completed and provides information on the temperature dependence of k sub infinity for a (U-233)O2-(Th-232)O2-C fuel mixture. The infinite medium multiplication factor was found to decrease by .0322 plus or minus .0016 from 20 C to 1000 C. This result provides direct information necessary in the design of the control system and in the safety analysis for advanced high-temperature gas-cooled reactors. Author (NSA)

N71-38271# Oak Ridge National Lab., Tenn.
CONCEPTUAL DESIGN STUDY OF A SINGLE-FLUID MOLTEN-SALT BREEDER REACTOR
Roy C. Robertson, comp. Jun. 1971 207 p refs
(Contract W-7405-eng-26)
(ORNL-4541) Avail: NTIS

Design calculations and parameters for a reference 1000 MW(e) single-fluid molten-salt reactor are presented under the following topics: overall systems descriptions and features; reactor primary system; coolant-salt circulating system; steam-power system; fuel-salt drain system; reactor off-gas system; fuel-salt processing system; liquid waste disposal system; plant operation, control, and instrumentation; auxiliary systems; maintenance and repair systems; buildings and containment; site description; cost estimates for MSBR station; and uncertainties and alternatives, and their effects on feasibility and performance. NSA

N71-38272# Commissariat a l'Energie Atomique, Cadarache (France). Centre d'Etudes Nucleaires.
EFFECT OF FISSILE NUCLEI CONSUMPTION ON POWER AND TEMPERATURE DISTRIBUTIONS IN A FUEL ELEMENT [INFLUENCE DE LA CONSOMMATION DE NOYAUX FISSILES SUR LA REPARTITION DE PUISSANCE ET DE TEMPERATURE DANS UN ELEMENT COMBUSTIBLE]
Roger Cheriol, Jean Cuenet, and Christian di Felice Feb. 1971 57 p In FRENCH
(CEA-N-1416) Avail: AEC Depository Libraries

The evolution of the fissile nuclei number and the temperature

distribution inside a fuel element subjected to a long irradiation were studied. The use of hybrid computer enabled the algebraic and differential equations system to be solved. After a short report on the calculation method used, the task assigned to analog, logic, and digital components of the hybrid computer is explained. Author (NSA)

N71-38273# Westinghouse Electric Corp., Pittsburgh, Pa. Nuclear Energy Systems Div.
SOLID STATE LOGIC PROTECTION SYSTEM DESCRIPTION
D. N. Ketz Jun. 1971 59 p Sponsored by AEC
(WCAP-7672) Avail: NTIS

By applying solid state techniques to the design of the reactor protection and engineered safety features actuation systems, it is apparent that significant improvements can be made over previous designs utilizing relays. Designated as the solid state protection system, the design which includes both reactor protection and engineered safety features actuation uses integrated circuit NAND gates as the basic logic elements. These elements are assembled on printed circuit cards to form the building blocks for the system. Although reference to four loop plants is presented, the same building blocks are used in the two and three loop plant systems even though the required logic may be somewhat different. Author (NSA)

N71-38274# Pittsburgh Univ., Pa.
CONTROL AND STABILITY ANALYSIS OF THE PINCH-FISSION FAST-BREEDER CAVITY REACTOR
Wen-Juin King (Ph.D. Thesis) 1970 146 p refs Sponsored in part by NIH
Avail: NTIS

A configuration for a pinch fission fast breeder cavity reactor was described. A systematic approach was employed to derive the transfer functions and to obtain the frequency response of the system. Various methods of stability analysis such as Teypkin locus and Liapunov stability criteria were employed. A digital computer simulation was performed to obtain the system's responses under both square wave and sinusoidal cycle pinch current modulation. An equation oriented programming technique was used for digital simulation and a fourth order predictor-corrector method was used to solve the differential equations. Author

N71-38275# Kentucky Univ., Lexington.
FUSION POWER FOR INTERSTELLAR FLIGHT
Thomas Conley Powell (Ph.D. Thesis) 1970 186 p refs
Avail: NTIS

A detailed analysis of reaction equilibrium and plasma energy balance in fusion propulsion systems is presented. The potential of fusion drives for interstellar flight is assessed, the operating regimes of interest for more detailed studies are defined, and some engineering problems are discussed briefly. Interstellar drive optimization is considered. Results of numerical calculations are given along with a general discussion of the problem of interstellar flight. J.G.M.

N71-38276# Japan Atomic Energy Research Inst., Tokyo.
ABSOLUTE POWER MEASUREMENT BY REACTOR NOISE ANALYSIS
Hirokatsu Nakata Jan. 1971 29 p refs In JAPANESE; ENGLISH summary
(JAERI-Memo-4276) Avail: AEC Depository Libraries

The measurement of absolute reactor power by reactor noise analysis is described. Reactor power is obtained by analyzing the power spectral density of output current from detector located near a reactor core. Reactor power was measured in the range from 50 mW to several hundreds watts and the effect of detector location appeared to be unimportant. Power measured by this method was smaller than power measured by the flux integral method by a factor 0.86. The power meter of JMTR was calibrated by this method before increasing power level. Thermal power was greater than power indicated by the power meter by a factor 1.12. Author (NSA)

N71-38277*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
LARGE NUCLEAR-POWERED SUBSONIC AIRCRAFT FOR TRANSOCEANIC COMMERCE
Frank E. Rom and Charles C. Messer Washington Nov. 1971 47 p refs
(NASA-TM-X-2386; E-6271) Avail: NTIS CSCL 21F

Large subsonic aircraft, greater than 905 metric tons (1000 tons) gross weight, have the potential for hauling transoceanic cargo at rates in the range of $0.006 to $0.036 per metric ton-kilometer ($0.01 to $0.06/ton-n mi) at speeds of 740 to 925 kilometers per hour (400 to 500 knots). It theoretically would take a fleet of 500 such aircraft to handle 1 percent of the forecast world ocean trade in 1980. For gross weights of 3620 metric tons (4000 tons) the cargo rate would be reduced to less than $0.012 per metric ton-kilometer ($0.02/ton mi). It theoretically would take a fleet of over 1000 such aircraft to carry 8 percent of the world transoceanic trade projected for 1980 or 4 percent of the projected trade in 1995. Aircraft with a gross weight of 3620 metric tons (4000 tons) using compact lightweight nuclear reactors show better performance than chemical aircraft for ranges greater than 5565 kilometers (3000 n mi). Nuclear aircraft performance is less sensitive than that of chemical aircraft to the operating and cost assumptions used. Relatively large variations in any of the important assumptions have a relatively small effect on nuclear aircraft performance. Author

N71-38278*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECT OF SHIELD WEIGHT OF ADDING A FIXED-POSITION CONTAINMENT VESSEL IN THE UNIT SHIELD OF A 250-MEGAWATT MOBILE REACTOR
Millard L. Wohl and David Spielberg Washington Nov. 1971 19 p refs
(NASA-TM-X-2414; E-6462) Avail: NTIS CSCL 10J

The computer code UNAMIT was used to calculate optimized 4 pi-spherical, tungsten-water unit shield weights for three 250-megawatt reactors, a highly moderated, a lightly moderated, and a fast reactor. The effort on shield weight of the inclusion as part of the shield of a 1.39-meter (4.6-ft) inner radius refractory containment vessel of 5.08, 7.62, and 12.7 centimeter (2-, 3-, and 5-in.) thicknesses was calculated. The vessels were not optimally placed from a minimum shield weight point of view. The increases in shield weight due to inclusion of the vessels as part of the shields reflect the degree of nonoptimum placement of these thick layers of heavy material but were far less than the actual vessel weights. The vessels weighed 22,670, 34,900, and 59,900 kilograms (50,000, 77,000, and 132,000 lb). The total weight increase due to these vessels was 2,268, 5,890, and 15,420 kilograms (5,000, 13,000, and 34,000 lb), respectively. Author

N71-38279*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CORRELATION OF IRRADIATION DATA USING ACTIVATION FLUENCES AND IRRADIATION TEMPERATURE
John H. Lynch Washington Nov. 1971 16 p refs
(NASA-TN-D-6564; E-6493) Avail: NTIS CSCL 18I

A method of direct correlation of radiation damage with time-integrated activation of neutron dosimeters is described. The method is tested by using a consistently defined set of nil-ductility transition temperature data for A302-B ferritic steel and is compared to a correlation representative of damage function techniques. For the data studied, the new method is as accurate as the damage function method and its advantages over this method are pointed out. Also, the effect of irradiation temperature on damage is treated. Author

N71-38280 National Lending Library for Science and Technology, Boston Spa (England).
EXPERIENCE OF THE MATERIALS USED IN NUCLEAR

POWER PLANTS
G. Cuttica et al. [1970] 17 p refs Transl. into ENGLISH from Energ. Nucl. (Milan), v. 17, no. 8, Aug. 1970 p 469-490
(NLL-CE-Trans-5598-(9022.09)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

The structural integrity of certain nuclear power plant components is essential both to safe operation and achievement of high capacity factors. Described are a few aspects of special interest in the operation of nuclear power stations. Steel embrittlement under irradiation is reviewed, and various instances of material deterioration as a result of fatigue, oxidation or corrosion are described. Author

N71-38281 National Lending Library for Science and Technology, Boston Spa (England).
STUDY OF FUTURE FUEL COMPOSITIONS FOR FAST REACTORS BASED ON URANIUM AND PLUTONIUM CARBIDES
I. S. Golovnin et al 19 Aug. 1971 10 p refs Transl. into ENGLISH from Atomnaya Energ. (Moscow), v. 30, no. 2, Feb. 1971 p 211-216
(NLL-Risley-Trans-2184-(9091.9F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The utilization of carbide fuels for fast nuclear reactors is discussed. Techniques for producing uranium and plutonium monocarbides and carbide mixtures by pressing and coagulation, and hot pressing are outlined. A study of carbide compatibility with steel canning materials both before and after irradiation is summarized. J.M.

23 PHYSICS, GENERAL

Includes acoustics, cryogenics, mechanics, and optics. For astrophysics see: 30 Space Sciences. For geophysics and related information see also: 13 Geophysics; 20 Meteorology; and 29 Space Radiation.

N71-38282# Institute of Nuclear Physics, Krakow (Poland).
THEORY OF MAGNETIC DIPOLE MOMENTS OF SPHERICAL AND TRANSITION NUCLEI
Stanislaw Ogaza Nov. 1970 13 p refs
(INP-729) Avail: AEC Depository Libraries

Attempts were made to describe the magnetic properties of nuclei. The uncertainty in the theoretical estimates of magnetic moments arises from three main unsolved problems: the nucleonic interactions which modify somewhat the intrinsic structure of nucleons in nuclei and also the structure of the magnetic dipole operator; the distortion of the whole nucleus due to forces exerted by the valence nucleons on the core; and the complexity of the nuclear wave function for nuclei with more than one valence particle or hole. Developments in all the three problems are discussed. Author (NSA)

N71-38283*# Hamilton Standard, Windsor Locks, Conn.
RESULTS OF PROP-FAN/STOL WING ACOUSTICS TESTS
T. G. Ganger 29 Jul. 1971 79 p
(Contract NAS1-11019)
(NASA-CR-111950; HSER-5910) Avail: NTIS CSCL 20A

The results of a test conducted to determine the noise characteristics of a STOL wing with externally blown flaps in the vicinity of an aircraft propulsor are summarized. The STOL wing used for these tests was a 0.43 scale model with 60 deg and 0 deg flap capabilities; however, this wing system was not an optimum configuration, nor was it representative of all STOL wing/flap systems. The propulsor used was a low tip speed, high bypass ratio, low pressure ratio, variable pitch prop-fan model. Far field noise data and directional character were determined for a 60 deg and 0 deg flap configuration. In addition, the noise character of the 21 inch diameter prop-fan model without the STOL wing was evaluated. Author

N71-38284*# Oklahoma Univ. Research Inst., Norman.
MEASUREMENT OF THE VISCOSITY BY THE OSCILLATING CRYSTAL METHOD OF FOUR FLUIDS AS FUNCTIONS OF PRESSURE, SHEAR RATE AND TEMPERATURE Final Report
R. G. Rein, T. T. Charng, C. M. Sliepcevich, and W. J. Ewbank 1 Sep. 1971 65 p refs
(Contract NAS3-13467)
(NASA-CR-120786; ER-1754-1) Avail: NTIS CSCL 14B

Measurements of the viscosity of four synthetic lubricating fluids (Mobil XRM-109F, DuPont Krytox 143-AB, Humble FN-3158, and Humble FN-3158 plus ten volume percent of Kendall 0839) were made at temperatures to 300 F and pressures to 40,000 psig with an oscillating quartz crystal viscometer. Viscoelastic behavior of two of the test fluids (Mobil XRM-109F and Humble FN-3158 plus ten volume percent of Kendall 0839) was indicated at 100 F and elevated pressures, but current limitations in the experimental apparatus precluded further investigation of this phenomenon. However, in order to demonstrate the techniques, the viscoelastic behavior of one of the calibration fluids, di- (2-ethylhexyl) sebacate, was determined. These data were then used to compute the reduced elastic (storage) modulus and the shear relaxation spectrum as functions of reduced frequency. In addition, the effect of pressure and temperature on the density of the four test fluids was measured. Author

N71-38285*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A MEASUREMENT OF THE FAST LUMINESCENT DECAYS OF THE MV-50 LED
John F. Sutton Sep. 1971 9 p refs
(NASA-TM-X-65721; X-325-71-394) Avail: NTIS CSCL 20F

The fast luminescent decay of the GaAs-doped Si light-emitting diode was studied. The diode provides a fast, inexpensive, bright, and convenient light source for calibration of fast optical timing systems. A simple passive electronic module is described which allows the light source to be driven directly by a laboratory pulse generator. Author

N71-38286*# Arkansas Univ., Little Rock. Dept. of Electronics and Instrumentation.
AN OPTICAL INTERFEROMETRIC SYSTEM WITH A LINEAR ELECTRONIC DISPLAY OF PERIODIC AND APERIODIC MECHANICAL DISPLACEMENT
William Guy Hinson 9 Sep. 1971 127 p refs
(Grant NGL-04-001-007)
(NASA-CR-114375) Avail: NTIS CSCL 20F

A measuring system for the linear readout of both periodic and aperiodic mechanical displacements over a relatively broad frequency range was developed. The measuring system utilizes a Michelson interferometer with a cw laser as the light source. A double loop electronic feed-back control system stabilizes the interferometer and provides direct readout of the mechanical displacement. One loop stabilizes the interferometer path length thereby preventing ambient and mechanical fluctuations from coupling into the measuring system. The electronically detected output signal of the interferometer is conditioned and fed back to a voltage-to-displacement piezoelectric transducer which maintains a constant phase relationship between the two legs of the interferometer. A second control loop referred to as the high frequency or the measuring loop applies a conditioned electrical signal to a second voltage-to-displacement transducer placed in optical series with the transducer in the stabilization loop. This loop maintains a small constant phase difference between the two legs of the interferometer. Author

N71-38287*# National Aeronautics and Space Administration, Washington, D.C.
OPTICS: BIREFRINGENT DEVICE ALLOWING COMPARISON OF THE FOUCAULT METHOD WITH THE HILBERT TRANSFORM METHOD DURING OBSERVATION OF

PHASE DEFECTS [OPTIQUE DISPOSITIF BIREFRINGENT PERMETTANT LA COMPARAISON DE LA METHODE DE FOUCAULT ET DE LA METHODE PAR TRANSFORMEE DE HILBERT LORS DE L'OBSERVATION DE DEFAUTS DE PHASE]

Y. Belveux et al Oct. 1971 6 p refs Transl. into ENGLISH from Compt. Rend. Acad. Sci. (Paris), v. 269, ser. B, 3 Nov. 1969 p 894-896

(NASA-TT-F-14011) Avail: NTIS CSCL 20F

A device is described which, during observation of a phase object, allows production, with the same arrangement, of the Foucaultgram, the Hilbert transform or the image of the object itself. This device has the advantage of being able to work with a source of variable wavelength and can, in addition, allow study of birefringence of test specimens. Author

N71-38288*# Techtran Corp., Glen Burnie, Md.

STUDIES IN LIGHT DIFFRACTION BY ULTRASONIC WAVES. REPORT 1: EXPERIMENTS IN THE EXPECTED PERIODIC DISAPPEARANCE OF DIFFRACTION SPECTRA WITH ANGLE OF INCIDENCE ACCORDING TO THE RAMAN-NATH THEORY [STUDIEN UEBER DIE BEUGUNG VON LICHT AN ULTRASCHALLWELLEN. 1: MITTEILUNG. VERSUCHE UEBER DIE NACH DER RAMAN-NATSCHEN THEORIE ZU ERWARTENDE PERIODISCHE VERSCHWINDUNG DER BEUGUNGSSPEKTREN MIT DEN EINFALLS WINKEL]

Otohiko Nomoto Washington NASA Nov. 1971 25 p refs Transl. into ENGLISH from Proc. Phys. Math. Soc. Japan (Japan), v. 24, 1942 p 380-400

(Contract NASw-2037)

(NASA-TT-F-13965) Avail: NTIS CSCL 20F

Diffraction of light in transformer oil medium was effected with ultrasonic waves. Diffraction spectra resulting from various angles of light incidence to the sonic field show the periodic disappearance of only the low diffraction minima, not the whole spectrum. With the ultrasonic frequency of 10 to the 6th power Hz, an inclined incidence of light caused a slight disaymmetry of the diffraction spectra. Author

N71-38289*# Colspan, Inc., Boulder, Colo.

EXTERNAL INSULATION SYSTEMS FOR CRYOGENIC STORAGE SYSTEMS Final Report

John R. Wilson 28 Sep. 1971 76 p refs

(Contract NAS8-10583)

(NASA-CR-115203) Avail: NTIS CSCL 20L

The feasibility of application of multilayer dielectric film reflectors to cryogenic insulation materials technology is outlined. Future requirements for cryogenic thermal protection system performance are considered, and of radiant energy transport processes are briefly described. Author

N71-38290*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

MEASUREMENTS OF ETA RHO SUB n IN AN INTERVAL ABOUT T SUB LAMBDA FOR PURE HELIUM-4 AND FOR THREE DILUTE MIXTURES OF HELIUM-3 IN HELIUM-4

Raylor W. H. Webeler and Gabriel Allen Washington Sep. 1971 20 p refs

(NASA-TN-D-6516; E-6448) Avail: NTIS CSCL 07D

Measurements of the product of viscosity eta and normal density rho sub n have been made for pure He-4 and for three He-3 - He-4 mixtures over temperature intervals which included their respective lambda points. The measurements were made using a torsional crystal technique in which a piezoelectric, cylindrical quartz crystal was immersed in the sample fluid and driven at its resonant frequency in a fundamental torsional mode of vibration. The precision of the eta rho sub n-against-T measurements for the mixture was greater than any previous measurements in the vicinity of T sub lambda. Doubly reduced plots of eta rho sub n against T showed a slight but definite tendency for such curves to rotate clockwise about the (1,1) point with increasing X sub 3 up to about 0.06. Values of eta were derived from the measurements by computing rho sub n as a function of reduced temperature. For each mixture, both eta and d eta/dT were continuous across T sub lambda. No tendency was manifest for such curves to develop discontinuities as X sub 3 decreased. It was, therefore, inferred that both eta and d eta/dT of pure He-4 are continuous across T sub lambda (0). A further result obtained here is that up to mole fractions of 0.1, the lambda viscosity of the mixture eta sub lambda (X sub 3) bears a linear relation to the lambda temperature T sub lambda (X sub 3). Author

N71-38291# Lockheed Missiles and Space Co., Palo Alto, Calif.

SOUND RADIATION OF A VIBRATING CYLINDRICAL SHELL WITH AN IMPEDANCE COATING

O. S. Tonakanov [1971] 8 p refs Transl. into ENGLISH from Vestn. Mosk. Univ., Ser. 1, Mat. Mekhan. (Moscow), No. 1, 1971 p 33-40

Avail: NTIS National Translations Center, John Crerar Library, Chicago, Ill. 60616

Sound insulation, for vibrating surfaces under hydroacoustic experiment conditions by superposition of a thin coating possessing properties of an acoustically soft material on the outer surface, is investigated. The vibrations of an infinite cylindrical shell with nodal lines on the cylinder surface directed along the generator are considered theoretically. It is shown that the radiation can be reduced for each vibrational mode in a specific frequency range associated with the geometry of the cylindrical surface and coating, as well as with the parameters of the coating material. Author

N71-38292# Sandia Corp., Albuquerque, N.Mex.

THERMAL DIFFUSIVITY FINITE PULSE TIME CORRECTIONS

R. C. Heckman May 1971 24 p refs Sponsored by AEC

(SC-RR-710280) Avail: NTIS

Correction factors have been calculated using a Green's function method, which permit adjustment of thermal diffusivities determined by pulsed techniques to true values for the case when the pulse duration is comparable to the heat diffusion time. These so-called finite pulse time corrections were determined for a general class of triangular pulses which should approximate the output from a wide variety of sources, as well as for certain exact shapes experienced with the laser used in a thermal diffusivity facility. Author (NSA)

N71-38293# Drexel Univ., Philadelphia, Pa. Electrophysics Advanced Study Group.

PROPAGATION OF FINITE AMPLITUDE ACOUSTIC WAVES IN NONLINEAR RELAXING FLUIDS

Richard Klinman (Ph.D. Thesis) and Lester A. Kraus 22 Jun. 1971 222 p refs

(Contract N00014-67-A-0406-0003)

(AD-727316; TR-4) Avail: NTIS CSCL 20/1

The hydrodynamic equations for relaxing fluids are used to derive the evolutionary properties of longitudinal plane waves of finite amplitude in dispersive and dissipative media. The regimes of uniform and secular perturbation solutions, representing either shock free or possibly shock like solutions, are determined from the equations with no restriction on the dispersion number. Solutions are calculated to second order to demonstrate the main features of the progressive wave distortion in nonlinear relaxing media. Heuristic theories using an equivalent viscous model of relaxing media are evaluated through comparison with the correct relaxation results. A consistent consideration of the perturbation method leads to a representation of the thermal state functions containing many parameters of nonlinearity which include the well known B/A parameter. Finally, through recourse to the theory of characteristics it is demonstrated that, unlike thermoviscous media, relaxing media may sustain true discontinuities in the flow similar to those occurring in the nondissipative Riemann solution. Author (GRA)

N71-38294# Naval Underwater Systems Center, Newport, R.I.
MULTIPATH AND ATTENUATION STUDIES IN THE DEEP OCEAN
John P. Beam 18 May 1971 110 p refs
(AD-727101; NUSC-4081) Avail: NTIS CSCL 20/1

Analysis methods are developed for studying the various ray paths that connect widely separated acoustic sources and receivers in the ocean. For an arbitrary velocity profile and for a source and receiver located at arbitrary points in the medium, it is shown that acoustic propagation can be discussed in terms of one of four possible cases. For each case, a set of curves, called an angle range plot, can be developed and used in the interpretation of many features of the acoustic propagation. These features include the presence of caustics and the number and intensity of received arrivals from a single pulsed signal.
Author (GRA)

N71-38295# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE EMISSION OF ELECTROMAGNETIC WAVES OF AN IDEALLY CONDUCTING SPHERE, PULSATING IN A UNIFORM FIELD
V. N. Krasilnikov 17 May 1971 18 p refs Transl. into ENGLISH from Difraksiya i Izluchenie Voln (Leningrad), no. 4, 1965 p 192-199
(AD-727434; FTD-MT-24-90-71) Avail: NTIS CSCL 20/3

The motion of conducting bodies in constant or almost constant electromagnetic fields is a frequently used physical model. Thus, V. Ferraro uses, for an explanation of the nature of geomagnetic storms, the motion of ionized gas in a magnetic field. Let us note that such flows, which appear as a result of nonstationary processes in the atmosphere of stars (at least in the macroscopic layout), can possess relativistic rates. In this paper the author examines the interplay of an ideally conducting sphere of variable radius with a constant and uniform field.
Author (GRA)

N71-38296# Sylvania Electronic Systems-West, Mountain View, Calif. Electro-Optics Organization.
PARAMETRIC OSCILLATOR RESEARCH Final Report, 15 May 1969 - 15 Jul. 1971
E. O. Ammann, G. A. Massey, J. M. Yarborough, L. M. Osterink, and J. Falk 15 Jul. 1971 58 p refs
(Contract N00014-69-C-0298)
(AD-727127) Avail: NTIS CSCL 20/6

The objective of this program was to investigate techniques for extending the tuning range of optical parametric oscillators further into (a) the infrared and (b) the visible and ultraviolet. Two separate tasks were undertaken on this program. The first was an experimental and theoretical study of a proustite oscillator which was pumped by the 1.06 micron output of a Nd:YAG laser, and the second a study of an ammonium dihydrogen phosphate (ADP) oscillator which was pumped by the frequency-quadrupled output from a Nd:YAG laser. This report summarizes the results of two year's work on these tasks.
Author (GRA)

N71-38297# Pennsylvania State Univ., University Park. Osmond Lab.
LIGHT SCATTERING AND INFRARED SPECTROSCOPY Final Report, 1 Jul. 1970 - 30 Jun. 1971
D. H. Rank 30 Jun. 1971 10 p refs
(Contract N00014-67-A-0388-0012)
(AD-727122) Avail: NTIS CSCL 20/6

A summary of the work for the past year is given. Work on the infrared spectrum of C2H2 and the HF dimer is noted. In spontaneous scattering the sound speed in nitrogen at modest pressures has been measured. Anamolous depolarization ratios (Krishnan effect) in plastics has been observed. The use of a Fabry-Perot interferometer as a resonant reflector has been investigated as an enhancer of 90 deg scattering. In stimulated scattering the gain and phonon lifetime in the plastics PMMA and PEMA have been measured. A study of stimulated thermal Rayleigh scattering at 0 deg is in progress.
Author (GRA)

N71-38298# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CONSTANT STRONG MAGNETIC FIELDS
A. M. Prokhorov 25 Mar. 1971 24 p refs Transl. into ENGLISH from Priroda (USSR), no. 10, 1970 p 2-8
(AD-727431; FTD-MT-24-83-71) Avail: NTIS CSCL 20/3

A magnetic field exceeding 50-100 kOe is usually called a strong magnetic field. Fields of such magnitude are used primarily for the conducting of the most diverse experiments in physics and related fields of sciences. Extremely strong magnets are used as an inseparable part of various instruments and devices which cannot operate without a strong field. The article discusses basic methods of obtaining strong fields.
Author (GRA)

N71-38299# Naval Air Development Center, Johnsville, Pa. Systems Analysis and Engineering Dept.
OCEAN AMBIENT NOISE STATISTICS FOR THE DETECTION OF TRANSIENTS Final Report
Benson Polin 1 Jul. 1971 32 p refs
(AD-727595; NADC-SD-7143) Avail: NTIS CSCL 20/1

The report stems from the observation of data whose statistical parameters, such as the means and variances, mask essential information like transients or possibly target signal levels imbedded in background noise. Transient information in this report implies that a large displacement of a very small percentage of samples exists in the data. The report shows that this information contained within the means and variances of ocean ambient noise data can be removed by the manipulation of the differences of some of the higher order moments. Techniques in this analysis were specifically oriented to help solve detection problems currently faced by the Anti-Submarine Warfare community.
Author (GRA)

N71-38300# Admiralty Underwater Weapons Establishment, Portland (England).
THE HYDROPHONE RESPONSE OF A TRANSDUCER
D. Stansfield Sep. 1970 46 p refs
(AD-727978; AUWE-TN-408/70; NSTIC-29259) Avail: NTIS CSCL 17/1

Equations are derived for the variation with frequency of the voltage output from a hydrophone exposed to a constant acoustic pressure field. These equations include the effects of a tuning inductor and resistor in parallel with the hydrophone. The variation of the phase of the output voltage relative to the applied pressure is also calculated. Examples of particular cases are considered, and some illustrative curves presented. A method of estimating the absolute value of the hydrophone sensitivity is also described.
GRA

N71-38301# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
A PHOTORESISTOR SENSOR FOR LENS FOCUSING
A. P. Angelorov et al 4 Mar. 1971 15 p refs Transl. into ENGLISH from Tekh. Kino Telev. (Moscow), v. 14, 1970 p 40-42
(AD-727879; FTD-MT-24-332-70) Avail: NTIS CSCL 17/2

Considered are the properties of photoresistors on the basis of CdS and CdSe that change their longitudinal resistance during defocusing of optical image projected on its photosensitive surface.
GRA

N71-38302# RAND Corp., Santa Monica, Calif.
ON THE PHASE STRUCTURE AND MUTUAL COHERENCE FUNCTION OF AN OPTICAL WAVE IN A TURBULENT ATMOSPHERE
R. F. Lutomirski and H. T. Yura Jun. 1971 26 p refs
(Contract DAHC15-67-C-0141; ARPA Order 189-1)
(AD-727883; RM-6286-1-ARPA) Avail: NTIS CSCL 20/6

The present work shows that the most commonly used expression for the mutual coherence function (MCF) for an

optical wave propagating in a turbulent atmosphere is, in general, incorrect. This expression is based on an unphysical extrapolation of the Kolmogorov spectrum. Along an atmospheric path, with specified turbulence parameters, the new MCF is shown to imply greater resolution, less beam spreading, and greater heterodyne signal-to-noise ratios than indicated by previous calculations. By comparing these results with those previously obtained for heterodyne detection, the percentage errors in the previous calculations are shown to increase with decreasing propagation paths. In particular, where it was formerly thought that the atmosphere limited the effective coherent detection size in heterodyne detection at all ranges, the present calculation reveals that over sufficiently short paths, there is no size limit imposed by the atmosphere. Author (GRA)

N71-38303# Marquette Univ., Milwaukee, Wis.
THEORY OF CONDUCTIVE BUT NONMAGNETIC LIQUIDS IN TIME VARYING MAGNETIC FIELDS
Demetrios P. Papadopoulos (Ph.D. Thesis) May 1970 123 p refs
Avail: NTIS

The general mathematical theory of viscous, incompressible, electrically conductive, non-polarizable, non-magnetic, and Newtonian fluids in time-varying magnetic fields is presented. The presentation neglects displacement currents, currents arising from charge transport, forces on concentrations of free charge, and gravitational forces. A nonrelativistic approach is employed. The formulation is based on the Eulerian approach. The case of a rectangular channel occupied by a liquid at rest having the above characteristics, and constrained from moving either conceptually or physically, to which a traveling magnetic field is applied, was completely analyzed. The analysis revealed the mathematical nature of the current density, magnetic flux density, electromagnetic forces, and static pressures developed in the liquid, and also the current density, and magnetic flux density induced in the channel walls. Author

N71-38304# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE CALCULATION OF ELECTRICAL CAPACITANCE
Yu. Iossel et al 14 Apr. 1971 295 p refs Transl. into ENGLISH of the book "Raschet Elektricheskoi Yemkosti" Leningrad, Leningradskoye Otdeleniya Energiya, 1969 p 1-240
(AD-727198; FTD-MT-24-269-70) Avail: NTIS CSCL 20/3

The book describes methods used to calculate electrical capacitance. It contains calculation formulas, tables, and graphs necessary for determination of the capacitance of various forms of conductors. GRA

N71-38305 National Lending Library for Science and Technology, Boston Spa (England).
PRECIPITATES AND FLUX LINE PINNING IN A SUPERCONDUCTING Pb-Na ALLOY
J. Peterman 11 May 1971 21 p refs Transl. into ENGLISH from Z. Metallk. (Stuttgart), v. 61, no. 10, 1970 p 724-733
(NLL-CE-Trans-5559-(9022.09)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

In a type 2 superconducting Pb + 7 at.% Na alloy, various states of precipitation were produced and investigated by electron microscopy. From differential magnetization measurements it was possible to calculate the critical flux gradients as a function of the magnetic flux and hence the pinning forces of the precipitates per unit volume of the flux line lattice. Homogeneous coherent precipitate particles were spherical and aligned along the < 100 > direction if their radius was $r > 210$ A and rod shaped if their radius $r > 470$ A. For crystals oriented approximately along < 100 > a maximum appeared in the magnetization curves and in critical flux gradients. It could be traced to a geometric correlation between the particle spacing and flux line lattice parameter. The maximum pinning force exerted by a particle on a flux line was computed for this case and was compared with theoretical estimates. For specimens oriented close to < 111 > no corresponding maxima were observed. Author

N71-38306 National Lending Library for Science and Technology, Boston Spa (England).
TEMPERATURE DEPENDENCE OF D2O AND HOD SPECTRA IN NEAR IR EXTENDING INTO SUPERCRITICAL REGIONS
W. A. P. Luck et al [1970] 24 p refs Transl. into ENGLISH from Z. Naturforsch. (Tuebingen), v. 24, no. 5, 1969 p 482-494
(NLL-CE-Trans-5458-(9022.09)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

Temperature dependences of the IR overtone spectra of D2O and HOD in the liquid state under saturation conditions into supercritical regions are discussed. The proportions of open OH or OD groups not bound by means of H-bridges are estimated according to a single-point method and the band area of the free vibrations. Both methods agree well with each other and with the results previously obtained with H2O. A quantitative discussion of the H-bridge bands is less accurate owing to band superimpositions. But the HOD bands can be represented quantitatively in all details by the addition of three bands of temperature-dependent intensity using the du Pont curve analyser. The assertion that there are about 10% open OH groups at 0 C and a simple water model of three species with broad energy states are described. Author

N71-38307 Temple Univ., Philadelphia, Pa.
A STUDY OF THE SPACE-TIME DEPENDENCE OF THERMODYNAMIC CORRELATION FUNCTIONS IN EXCHANGE COUPLED PARAMAGNETS
Daniel George McFadden (Ph.D. Thesis) 1970 198 p
Avail: Univ. Microfilms Order No. 70-19760

The structure of the space-time dependent spin correlation functions for an anisotropic Heisenberg paramagnet with cylindrical symmetry at an elevated temperature is analyzed in terms of a two parameter Gaussian representation of the generalized diffusivity. The parameters are chosen to exactly preserve the frequency moments of the longitudinal and the transverse spectral functions. The moments are calculated for arbitrary spin, arbitrary range of the exchange interactions, and for arbitrary dimensionality. The results for the correlation functions are worked out for one, two, and three dimensions. The adequacy of the formulation is ascertained by comparing the results with those of several exact solutions of the spin dynamics and by computing the exact sixth frequency moment to compare with predictions of the approximate spectral function. The agreement is generally found to be good. Dissert. Abstr.

N71-38308 Purdue Univ., Lafayette, Ind.
THE DEVELOPMENT OF A MODEL TO PREDICT THE EROSION OF MATERIALS BY NATURE CONTAMINANTS
William Joseph Head (Ph.D. Thesis) 1970 145 p
Avail: Univ. Microfilms Order No. 70-19660

Statistical models for predicting the erosion of both ductile and brittle target materials were developed on the basis of laboratory erosion tests. The models developed for ductile materials were considered adequate predictors of erosion produced by natural contaminants. Insufficient data were available to assess the predictive ability of the models for brittle materials. Contaminants and target materials with varying physical properties were used in the laboratory erosion tests. The apparent impingement angles of the contaminants were controlled. In addition, the impact and rebound velocities of selected particle size components of two contaminants were measured photographically with the aid of a high-speed flash light source. It was concluded that if the mechanism by which erosion was accomplished were held constant, the primary cause of steady state erosion was the energy transmitted from the impinging particles to the target. It was also concluded that a certain quantity of energy must be transmitted to a target (threshold energy) before erosion commences. Dissert. Abstr.

N71-38309 Rhode Island Univ., Kingston.
ACOUSTIC PROPAGATION IN A STRATIFIED MEDIUM
Frederick R. Di Napoli (Ph.D. Thesis) 1969 91 p

Avail: Univ. Microfilms Order No. 70-14147

The solution for the acoustic field due to a monochromatic point source located in a stratified medium is obtained by direct numerical integration of the relevant hydrodynamical field equations. The application of the method is demonstrated via various examples and shown to provide accurate results. In order to implement the formalism, it is necessary to solve for the depth dependent Green's function associated with the reduced wave equation. Two general methods of solution are presented and discussed. The first is an exact representation in terms of hypergeometric functions. The second has its foundations in the theory of integral equations. Dissert. Abstr.

N71-38310 New York Univ., N.Y.
THE OPTICAL CONSTANTS (n,K) OF AMMONIUM SULFATE IN THE INFRARED
Eugene E. A. Chermack (Ph.D. Thesis) 1970 122 p
Avail: Univ. Microfilms Order No. 70-18992

The optical constants of ammonium sulfate were determined in the laboratory by reflectance, transmittance measurements and by Fresnel reflection measurements. The range of the investigation covered the spectral intervals 1.20 to 2.70 microns and 3.45 to 10.77 microns. Ammonium sulfate was found to exhibit several weak absorption bands in the near infrared. The optical constants for two strong bands in the middle infrared were recovered as well. Trial calculations of the contributions to atmospheric scattering, absorption-emission, and the heating/cooling rate by the aerosol were made using these data and characteristics of the aerosol. Attenuation by scattering and absorption in the stratospheric aerosol due to sulfate particles is quite small, but attenuation in the troposphere due to this component could amount to 1 to 8%. It was also found that contributions to the sky radiance by sulfate particulates could account for from 3 to 30% of the total in strong sulfate absorption bands. Dissert. Abstr.

24 PHYSICS, ATOMIC, MOLECULAR, AND NUCLEAR

Includes atomic, molecular, and nuclear physics. For applications see: 22 Nuclear Engineering. For related information see also: 29 Space Radiation.

N71-38311# Institute of Nuclear Research, Warsaw (Poland).
BINDING ENERGY OF H-3 AND n-d DOUBLET SCATTERING LENGTH WITH RANK FOUR SEPARABLE POTENTIAL
J. Dabrowski and M. Dworzecka 1970 56 p refs Submitted for publication
(INR-P-1234) Avail: AEC Depository Libraries

Separable charge-independent nucleon-nucleon potentials containing an attraction and a hard core repulsion in the 1S0 state and the Yamaguchi tensor interaction in the 3S1 + 3D1 state are used to calculate the H-3 ground state energy E Sub T and the n-d doublet scattering length 2a. The potential that gives the best fit to the nucleon-nucleon data is E Sub T = -8.91 MeV, 2a = 0.88 F. All results fall on the Phillips line. A derivation of the system of coupled integral equations for the bound state and for the scattering problem for an arbitrary-rank potential acting in the 1S0 and 3S1 + 3D1 states is included. Author (NSA)

N71-38312# Comitato Nazionale per l'Energia Nucleare, Frascati (Italy). Lab. Nazionali di Frascati.
MULTIPLE e.m. PROCESSES IN HIGH ENERGY e MINUS e PLUS OR MINUS COLLISIONS
M. Greco 8 Jan. 1971 14 p refs
(LNF-71/1) Avail: AEC Depository Libraries

The production of electron and muon pairs is studied in high energy electron electron and electron positron collisions. Total and differential cross sections are discussed with special regard to experimental implications. Hadron production via photon-photon scattering is also studied. Author (NSA)

N71-38313# Atomic Energy Establishment, Cairo (Egypt). Dept. of Accelerators and Plasma Physics Research.
EFFECT OF FRINGING FIELDS ON THE ION BURST DURATION IN A PARALLEL PLATE PULSER
A. Moustafa, M. E. Abdelaziz, and I. I. Sadawy 1969 16 p refs
(UARAEE-77) Avail: AEC Depository Libraries

In a parallel plate pulser for the production of milimicrosecond pulsed ion beams, the beam is swept across an aperture by the effect of the electrostatic field due to the rf potential imposed on the plates. Theoretical analysis for the deflector plate sweeping method is discussed. The effects of the fringing fields at the deflector plate ends are studied. It is shown that the fringing fields at the plate ends act as though the plate length were extended by an amount directly proportional to the deflector plate spacing. This would give relatively shorter ion burst durations at the defining aperture. Author (NSA)

N71-38314# Kernforschungszentrum, Karlsruhe (West Germany). Inst. Fuer Neutronenphysik und Reactor-technik.
MEASUREMENT OF THE (n, GAMMA) CROSS SECTION FOR Tc-99, Eu, Sm, AND Fe IN THE ENERGY RANGE 1 eV AND 50 keV WITH A SLOWING-DOWN-TIME SPECTROMETER [MESSUNG VON (N GAMMA)-WIRKUNGSQUERSCHNITTEN FUER TC-99, EU, SM UND FE IM ENERGIEBEREICH 1EV BIS 50KEV MIT EINEM BREMSZEITSPEKTROMETER]
Jan-Cheng Chou Nov. 1970 79 p refs In GERMAN; ENGLISH summary
(NP-18773; INR-4/70-28) Avail: AEC Depository Libraries

The (n gamma) cross sections for Tc-99 Eu, Sm, and Fe were measured with a slowing-down-time spectrometer in energy range from 1eV to 50 keV. A normalization method is used, which is based on the absolute calibration of the gamma detector as well as the BF3 neutron detector. The measured capture cross section were analyzed considering only the first two partial waves (l = 0 and 1 = 1). The p-wave strength functions obtained are compared. For the well-resolved resonances, the resonance parameters were determined with the help of the area method. Author (NSA)

N71-38315# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Moscow (USSR). Inst. Teoreticheskoi i Eksperimentalnoi Fiziki.
MEASUREMENT OF THE RATIO OF THE U-235 AND Pu-239 CAPTURE AND FISSION CROSS SECTIONS
F. N. Belyaev, K. G. Ignatev, S. I. Sukharuchkin, S. P. Borovlev, V. V. Pavlov et al 1970 12 p refs In RUSSIAN; ENGLISH summary
(NP-18789) Avail: AEC Depository Libraries

Because of inconsistencies in alpha values for Pu-239 in the neutron energy range of several keV, measurements of this parameter for U-235 and Pu-239 were performed by means of a neutron spectrometer. Fission and capture effects from metal foil were measured independently by two methods using different kinds of detectors, located on the 14.6-m path flight. Alpha values for U-235 and Pu-239 were obtained in the energy range of neutrons from thermal to 10 keV. Author (NSA)

N71-38316# Jyvaskyla Univ. (Finland). Dept. of Physics.
UNITARITY CALCULATION FOR ELASTIC SCATTERING BASED ON UNCORRELATED JET MODEL WITH REGGE PHASES
Seppo Sohlo Mar. 1971 11 p refs
(NP-18823; RR-1/1971) Avail: AEC Depository Libraries

Using unitarity the imaginary part of the elastic scattering amplitude for identical bosons is calculated. It is assumed that the amplitudes of the intermediate states factorize in momenta.

transverse momenta are limited, and the phases of one-particle amplitudes are given by the Regge model. The resulting expression is a sum of exponential functions in four-momentum transfer t with slopes growing as the multiplicity of intermediate states increases. The energy dependence is included in n particle production cross sections multiplying the exponential t dependent functions. Author (NSA)

N71-38317# Saha Inst. of Nuclear Physics, Calcutta (India).
[NUCLEAR PHYSICS] Annual Report, 1969
1969 216 p refs
(NP-18683) Avail: AEC Depository Libraries

Research activities in accelerator studies, nuclear physics, and biophysics are discussed. Highlights for the year include the following: Coulomb excitation and proton initiated reactions lending to nuclear level data; energy levels of short-lived radioactive nuclei; nuclear spectroscopy, solid state physics, and crystal properties; structure and functions of biomolecules; physical biology, molecular genetics, radiation biology, and ultrastructure; elementary particles and applications of current algebra; stable crystal controlled generators; duo-plasmatron operation, solenoid magnet for producing long PIG discharges, neutron cross section data, and fission energy kinetics. N.E.N.

N71-38318# Atomic Energy Establishment, Cairo (Egypt). Reactor and Neutron Physics Dept.
NEUTRON TRANSMISSION THROUGH DUCTS PERPENDICULAR TO NEUTRON BEAM AXIS IN WATER SHIELDS
F. M. Seyed Ahmed, S. Belov, R. Megahid, and I. Hamouda
1969 17 p refs
(UARAEE-86) Avail: AEC Depository Libraries

The thermal neutron flux distributions were measured along the axis of hollow, cylindrical, air-filled ducts of diameters D = 29, 58, and 100 mm. The ducts were placed in a water-filled tank positioned at one of the horizontal beam channels of the UA-RR-1 reactor so that the duct axis was perpendicular to the beam axis. The distributions obtained were approximated by exponential functions of the distance along the duct axis and the duct effect, defined as the ratio of the neutron flux at a point on its axis to the neutron flux in water at the same place when the duct is filled with water, and are approximately described by an exponential with parameter dependent on D to the 0.75th power. Author NSA

N71-38319# Institute of Nuclear Techniques, Krakow (Poland).
TABLES OF MAGNETIC STRUCTURES DETERMINED BY NEUTRON DIFFRACTION. PART 3: RHOMBOHEDRAL AND HEXAGONAL SYSTEMS. ELABORATION AND REDACTION
A. Oles, A. Bombik, F. Kajzar, and M. Kucab Jan. 1971 86 p refs
(NP-18845) Avail: AEC Depository Libraries

Tables of the magnetic structures determined by neutron diffraction were elaborated on the basis of the original papers. The tables contain the chemical symbol of the substance, its space group, crystallographic data, cation distribution, temperatures of magnetic transitions, a brief description of magnetic structure including some figures, magnetic moments and their directions, effective magnetic moments, and references on magnetic additional properties. Magnetic space groups for stoichiometric compounds are indicated. The third part of the tables contains compounds and alloys belonging to the rhombohedral and hexagonal systems at room temperature. Author (NSA)

N71-38320# Atomic Energy Establishment, Cairo (Egypt). Reactor and Neutron Physics Dept.
TRANSMISSION OF SLOW NEUTRONS IN MULTIPLE-SEGMENT DUCTS IN A WATER SHIELD
F. M. Seyed Ahmed and I. Hamouda 1970 20 p refs
(UARAEE-104) Avail: AEC Depository Libraries

Transmission in air-filled cylindrical duct segments joined at 90 deg angles was studied. The ducts were located in a water-filled tank placed in front of a horizontal beam channel of the reactor, with the axis of the first segment coincident with the axis of the neutron beam. The transmission was taken as the ratio between the flux at the end of each segment of the duct and the incident flux. The transmission at the end of the second bend was found to decrease with increase in offset length and to increase with increase in duct diameter. The ratio of the flux measured at the end of the multiple-segment duct to the entrance flux was compared with calculations for fast neutrons. A semiempirical formula was obtained to allow for the difference in source geometry and for the energy range of neutrons considered. An empirical formula was derived which indicates that the duct effect at the end of the third segment is a function of the product of the effect at the end of the preceding two segments, duct diameter, and the offset length. Author (NSA)

N71-38321# Academy of Sciences of the Ukranian SSR, Kiev (USSR). Inst. of Theoretical Physics.
REVIEW OF HADRON SYMMETRIES: MULTIPLETS, SUPERMULTIPLETS AND INFINITE MULTIPLETS
A. O. Barut (Colorado Univ.) 1970 103 p refs Presented at 15th Intern. Conf. on High Energy Phys., Kiev, 26 Aug. - 4 Sep. 1970
(ITF-70-102-E; Conf-700806-60) Avail: AEC Depository Libraries

A review is given of the classification scheme of hadron states and hadron structure, especially the high lying excited states. Hadron quantum number, properties, and multiplets, the naive quark model for high lying states, relativistic treatment of orbital and radial excitations, passage to dynamical groups and infinite multiplets, current algebra and infinite hadron states, and implications of other hadron models for hadron states are treated. Also considered are a simple proton model, and mathematical results. NSA

N71-38322# Academy of Sciences of the Ukranian SSR, Kiev (USSR). Inst. Teoreticheskoi Fiziki.
ON INVESTIGATION OF REACTIONS IN THE SYSTEM OF HEAVY NUCLEUS AND TWO NEUTRONS
V. S. Olkhovskii 1970 12 p refs In RUSSIAN
(ITF-70-97-P) Avail: AEC Depository Libraries

The problem of describing all possible transitions in the system of heavy-nucleus-plus-two-neutrons is considered under the condition that there is a coupled system of nucleus-plus-one-neutron and an incident neutron. For a rather wide class of conditions, one can use the more simple equation of the Gell-Mann-Goldberger type instead of Feddeev's equation. The possibility of algebraizing the integral equations for the T matrix by expanding the function in terms of the total system of discrete functions is studied. Author (NSA)

N71-38323# Academy of Sciences of the Ukranian SSR, Kiev (USSR). Inst. Teoreticheskoi Fiziki.
THREE-NUCLEON PROBLEM WITH REPULSIVE-CORE POTENTIALS
V. F. Kharchenko and S. A. Shadchin 1970 29 p refs
(ITF-70-92-E) Avail: AEC Depository Libraries

The three-nucleon problem with the pair local interaction containing a repulsion at small distances is considered on the basis of Feddeev's formalism using the Hilbert-Schmidt separable representation for the two-particle t-matrix. The problem is reduced to solving the set of integral equations for the functions depending only on one variable. The triton binding energy and the neutron-deuteron scattering lengths are considered for the square-well potential with the infinite repulsive core. The parameters of the pair potential were determined from the data on two-nucleon interaction at the energies of nucleon in the interval from 0 to 400 MeV (in a laboratory system). Author (NSA)

N71-38324# Academy of Sciences of the Ukranian SSR, Kiev (USSR). Inst. Teoreticheskoi Fiziki.
KIRKWOOD-SALSBURG EQUATIONS FOR THE COEFFICIENT FUNCTIONS OF THE SCATTERING MATRIX
D. Ya. Petrina and V. I. Skripnik 1970 15 p refs
(ITF-70-108-E) Avail: AEC Depository Libraries

The equations of the Kirkwood-Salsburg type are obtained for the coefficient functions of the scattering matrix in the Euclidean region. The existence of the solutions of the equations for the coefficient functions at infinite volume is proved for the models of the real scalar field with bounded nonlinear Lagrangians. The analogies between the Euclidean quantum field theory and statistical mechanics are investigated. Author (NSA)

N71-38325# Paris Univ. (France). Faculte des Sciences.
THEORETICAL STUDY OF HYPERON-NUCLEON SCATTERING USING A MANY-CHANNEL FORMALISM [CONTRIBUTION A L'ETUDE THEORIQUE DE LA DIFFUSION HYPERON-NUCLEON DANS UN FORMALISME A PLUSIEURS CANNAUX]
Jean Lotesoler (Ph.D. Thesis) 1970 100 p refs In FRENCH
(NP-18838) Avail: AEC Depository Libraries

The hyperon-nucleon interaction is studied in a many-channel formalism. The total and differential cross sections of Lambda hyperon nucleon yields Lambda hyperon nucleon and Sigma hyperon nucleon yields Sigma hyperon nucleon coupled processes are calculated in the framework of the crossed channel boson exchange model. The Lambda hyperon nucleon yields Sigma hyperon nucleon inelastic channel is introduced by the N/D matrix method which enables a unitarized low energy contribution of the Regge trajectories exchanged through crossed channels to be obtained by treating together all hyperon-nucleon processes in the T=1/2 isospin state. One of the important characteristics of the model is the complete absence of resonance in the Lambda hyperon nucleon states as well as the Sigma hyperon nucleon states, at low energies, for partial waves with an angular momentum less than 4. NSA

N71-38326*# Rensselaer Polytechnic Inst., Troy, N.Y. Chemistry Dept.
PHOTODISSOCIATION OF NO2 BY PULSED LASER LIGHT AT 6943 A
John W. Gerstmayr, Paul Hartsck, and Robert R. Reeves Aug. 1971 17 p refs
(Grant NGL-33-018-007)
(NASA-CR-123205) Avail: NTIS CSCL 20H

Nitrogen dioxide was photodissociated using a pulsed ruby laser at 6943A. The energy of a single photon at this wavelength was equivalent to only 57% of the dissociation energy. The mechanism proposed to account for the results was the consecutive absorption of two photons, the first resulting in a short-lived excited state. The second photon is then absorbed by the excited species resulting in dissociation. Author

N71-38327*# Pittsburgh Univ., Pa.
GLAUBER THEORY OF ATOMIC HYDROGEN EXCITATION BY ELECTRON IMPACT
H. Tai, R. H. Bassel, E. Gerjuoy, and V. Franco (City Univ. of New York) [1970] 50 p refs Supported in part by AEC
(Grant NGR-30-011-035; Contract DA-31-124-ARO(D)-440)
(NASA-CR-122926) Avail: NTIS CSCL 20H

The Glauber approximation has been applied to excitation of the 2s, 2p, 3s and 3p levels of the hydrogen atom by electron impact. The differential and integrated excitation cross sections predicted by Glauber theory have been compared with experiment and with other calculations. The Glauber approximation is a considerable improvement over the Born approximation at energies less than or equivalent to 100 eV. At energies greater than or equivalent to 100 eV the Glauber total excitation cross sections approach the Born, even though at large scattering angles (greater than 40 deg) the Glauber differential cross sections may be very different from the Born. At intermediate energies (equivalent to 30 eV - 100 eV) the Glauber predictions are surprisingly good: at energies equivalent to 20 eV the Glauber integrated cross sections are rather smaller than observed experimentally. Author

N71-38328*# Oak Ridge National Lab., Tenn., Neutron Physics Div.
EXPERIMENTAL NUCLEAR CROSS SECTIONS FOR SPACECRAFT SHIELD ANALYSIS
R. W. Peelle Apr. 1971 23 p refs Presented at the Natl. Symp. on Nat. and Manmade Radiation in Space, Las Vegas, Nev., 1-5 Mar. 1971 Sponsored in part by AEC
(NASA Order L-12186)
(NASA-CR-123201; Conf-710304-9; ORNL-TM-3376) Avail: NTIS CSCL 20H

Experiments were performed to validate and to supplement the intranuclear cascade model as a method for estimating cross sections of importance to spacecraft shield design. The experimental situation is inconclusive particularly for neutron producing reactions, but is relatively sound for reaction cross sections and for proton spectra at several hundred MeV at medium forward angles. Secondary photon contributions are imprecisely known. Author (NSA)

N71-38329# Aktiebolaget Atomenergi, Studsvik (Sweden).
RELATIVE SIGNS OF PRINCIPAL ELEMENTS OF THE ALPHA-PROTON HYPERFINE COUPLING TENSOR IN NH SUB 2 CONHO
Anders Lund and Thomas Gillbro 1970 8 p refs
(NP-19449; LF-28) Avail: AEC Depository Libraries

The relative signs of the proton coupling tensor of the radical NH2CONHO formed from gamma-irradiated hydroxyurea crystals were determined by comparing experimental and calculated spectra for orientations of the crystal in which Delta M sub I = 1 transitions were observed. It was found that the anisotropy could be explained by taking into account the contributions of the dipolar interaction between spin densities on the oxygen atom, as well as that on the nitrogen atom, and the proton. In a similar way the N-H bond distance = 1.0 A and effective charge of the nitrogen nucleus Z = 3.7 of the NH2CONHO radical were found adequate to explain the anisotropy of the proton coupling in the N2H4(+) ion when the contribution from spin density on the nonadjacent nitrogen atom was included. Author (NSA)

N71-38330# Paris Univ., Orsay (France). Lab. de l'Accelerateur Lineaire.
BEAM-BEAM EFFECT: THE POTENTIAL IN A BI-GAUSSIAN BEAM [EFFET FAISCEAU-FAISCEAU: POTENTIEL DANS UN FAISCEAU BI-GAUSSIEN]
X. Buffet and D. Potaux 13 Feb. 1970 12 p In FRENCH
(LAL-RT-e-70) Avail: AEC Depository Libraries

An infinitely long beam of uniform density in the direction of the azimuth and of bi-gaussian charge distribution in the transverse plane is considered. The potential produced is calculated from the Poisson equation. NSA

N71-38331# European Organization for Nuclear Research, Geneva (Switzerland).
COMPILATION OF CROSS SECTIONS. 3: KAON(PLUS) INDUCED REACTIONS
E. Flaminio, J. D. Hansen, D. R. O. Morrison, and N. Tovey Sep. 1970 88 p refs
(CERN-HERA-70-4) Avail: AEC Depository Libraries

A compilation of cross section of reactions produced by positive kaons on targets of protons, neutrons and deuterons is presented. Graphs of the variation of cross section with incident laboratory momentum are plotted. Values for the rate of decrease of cross section with incident momentum are given. Author (NSA)

N71-38332# Central Research Inst. for Physics, Budapest (Hungary). Nuclear Physics Dept.
SURVEY OF MEASUREMENTS OF THE FISSION NEUTRON SPECTRUM OF Cf-252
L. Jeki, Gy. Kluge, and A. Lajtai [1970] 15 p refs
(KFKI-71-9) Avail: AEC Depository Libraries

The background sources arising in different techniques for measuring fission-neutron energies were studied in detail, and the background due to the detection of delayed gamma rays was calculated. The proposed value of the Maxwellian temperature for the energy distribution of neutrons from the spontaneous fission of Cf-252 is about T = 1.57 MeV. Author (NSA)

N71-38333# Joint Inst. for Nuclear Research, Dubna (USSR).
INVESTIGATION OF SHORT-LIVED ISOMERS OF THE TERBIUM ISOTOPES: Tb-148, Tb-149, Tb-150, AND Tb-152
G. Beyer, R. Arl't, V. V. Kuznetsov et al 1971 15 p refs In RUSSIAN
(JINR-P6-5681) Avail: AEC Depository Libraries

A number of new gamma transitions produced in the decay of Tb-149 and Tb-152 isomers, as well as in the decay of the previously unknown isomers of Tb-150 (half life = (6.0 + or - 0.1) min) and Tb-148 (half life = (2.1 + or - 0.1) min), were observed. Partial decay schemes for the isotopes are suggested. Author (NSA)

N71-38334# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.
RELATIVE YIELDS OF SECONDARY ((p,xn)ALPHA) REACTIONS ON Bi IN THE RANGE E SUB p EQUALS 120-660 MeV
Li Tsun Chi, N. S. Maltseva, and V. N. Mekhedov 1970 14 p refs In RUSSIAN
(JINR-P1-5530) Avail: AEC Depository Libraries

The yields of the astatine isotopes At-203-210 were determined relative to At-211 as a function of proton energy by measuring the alpha spectra of astatine by using a semiconductor alpha spectrometer. Author (NSA)

N71-38335# Joint Inst. for Nuclear Research, Dubna (USSR).
PION(MINUS) PROTON YIELDS PION(0) PION(0) NEUTRON REACTION AT 447 MeV
V. Dainet, G. Myuller, D. Schmitt et al 1971 24 p refs In RUSSIAN
(JINR-P1-5781) Avail: AEC Depository Libraries

Differential cross sections for the neutrons resulting from the reaction pion(-) proton yields pion(0) pion(0) neutron at 447 MeV were measured for the angle range 20 to 60 deg in the lab system. The experiment was performed at the CERN proton synchrotron using the missing-mass spectrometer combined with optical spark chambers. The experimental effective mass spectrum of pion(0) pion(0) system has a noticeable enhancement over the phase space distribution in the region of large and small masses and a dip in the middle of the spectrum. The angular distribution for neutrons in the c.m.s. has sharp asymmetry with the prevailing backward escape of neutrons. Author (NSA)

N71-38336# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.
DECAY OF Ta-123
B. Bochev, R. Broda, I. Zvolski, J. Molnar, and N. Nenov 1971 15 p refs In RUSSIAN
(JINR-P6-5704) Avail: AEC Depository Libraries

Spectra of conversion electrons, gamma rays, fast and delayed gamma-gamma coincidences, and triple beta(+)-gamma coincidences were studied. The decay scheme of Ta-173 to Hf-173 is suggested. The bands of the states 1/2(-)/521/ (ground state),5/2(-)/512/ (107.2 kev), and 7/2(+)/633/ (197.3 keV), were observed, as well as states at 785 keV, 872 keV, 942.1 keV 1209 keV, 1248 keV and 1450 keV. The half-lives of the states with E = 107.2 keV and E = 197.3 keV were determined to be t sub 1/2 = 180 + or - 8 nsec and T sub 1/2 approximately 170 nsec, respectively. Author (NSA)

N71-38337# Israel Atomic Energy Commission, Tel Aviv.
FLUCTUATION FACTORS FOR THEORETICAL EVALUATION OF AVERAGE NEUTRON CROSS SECTIONS OF FISSILE NUCLEI IN THE UNRESOLVED RESONANCES REGION
Y. Gur and S. Yiftah Sep. 1970 48 p refs
(IA-1208) Avail: AEC Depository Libraries

In the course of evaluating elastic, fission, and capture cross sections it is necessary to compute, from basic data, dimensionless quantities called fluctuation factors. These factors are expressed as zero-to-infinity integrals. The role that these factors play in cross-section evaluation is discussed, and a full representation of their values in the entire range needed is given in both graphical and tabular form. The inappropriateness of the Gauss-Laguerre or Hermite-Chebyshev methods of integration for evaluating the factors is discussed, and a method is described that cuts down the computer time needed for the Simpson integration by a factor of about 40 compared with the straightforward method of Simpson integrations. Author (NSA)

N71-38338# Comitato Nazionale per l'Energia Nucleare, Roma (Italy).
DERIVED OPERATING LIMITS OF SURFACE CONTAMINATION
A. Moccaldi 25 Jan. 1971 32 p refs In ITALIAN
(RT/PROT-(71)7) Avail: AEC Depository Libraries

Derived working limits of surface radioactive contamination are proposed for the use of health physicists in the measurement of surface contamination. The most important radiological risks due to surface contamination are pointed out. Working limits, determined on the base of theoretical and experimental hypothesis, are presented. Author (NSA)

N71-38339# Paris Univ., Orsay (France). Faculte des Sciences.
STUDY OF THE Sm-153 YIELDS Eu-153 DECAY [ETUDE DE LA DESINTEGRATION DU SAMARIUM 153 EN EUROPIUM 153]
Yves Patin (Ph.D. Thesis) 1970 70 p refs In FRENCH
(NP-18835) Avail: AEC Depository Libraries

The Sm-153 isotope was produced by neutron irradiation of a Sm sample enriched in Sm-152 (98.18 p.%). The internal conversion electron spectrum was obtained using a 180 deg magnetic spectrometer; and the gamma ray spectrum, using Ge(Li) detectors; the two dimension gamma-gamma coincidence spectrum was also determined. The results obtained were interpreted. The Eu-153 nucleus is in the mass region described by the Nilsson model. It represents a special case, being a highly deformed nucleus in spite of being situated at the utmost limit of this region. A level scheme is proposed in which the levels are grouped in two clusters, one between 0 and 300 keV, the other above 600 keV. The results are compared with those recently obtained for Eu-155. NSA

N71-38340# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.
HADAMARA: TRANSFORM SCINTILLATION COUNTER
L. M. Soroko 1971 16 p refs In RUSSIAN
(JINR-P13-5696) Avail: AEC Depository Libraries

The gain in the effective signal to noise ratio achieved by this counter is the result of the spatial multiplexing, that is, of coding the spatial or angular distribution to be measured before counting it. The counter consists of a multielement heterogeneous scintillator, two lightguides and two photomultipliers. The multiscintillator consists of (2M-1) scintillation elements. The counting to be measured is equal to the difference between the number of N (up) (i) events and the number of N (down) (i) events at all M positions of the moving multiscintillator relative to the lightguide. It is needed to perform M independent measurements. The spatial distribution of particles is undergoing

the binary coding according to the Hadamard-transform algorithm. The Hadamard transform scintillator counter gives the direct economical gain in the time of particle accelerators and also in the cost of the equipment. Author (NSA)

N71-38341# Kernforschungsanlage, Juelich (West Germany). Inst. fuer Reaktorentwicklung.
METHOD FOR ANALYZING COMPLEX GAMMA SPECTRA IN SEMICONDUCTOR SPECTROSCOPY [VERFAHREN ZUR ANALYSE KOMPLEXER GAMMA-SPEKTREN IN DER HALBLEITERSPEKTROSKOPIE]
Klaus Ewalds Oct. 1970 127 p refs In GERMAN
(JUL-709-rg) Avail: AEC Depository Libraries

A suitable measurement method by which the isotope composition of gamma-active samples can be determined quantitatively was developed. The method is based on the gamma-spectroscopic measurement of the samples using a Ge(Li) semiconductor. The construction of the gamma spectrometer is described, and the theory of the spectral evaluation and the computer program are given. The preparation of calibration standards for all fission products considered is described. The measurement technique and the necessary correction are reported, and a second evaluation method based on the measurement of individual gamma lines is also developed. The two methods are compared. NSA

N71-38342# National Inst. for Metallurgy, Johannesburg (South Africa).
DETERMINATION, BY NEUTRON-ACTIVATION AND TRACER TECHNIQUES, OF THE LOSSES OF IRIDIUM DURING THE FIRE-ASSAY PROCEDURE FOR THE PLATINUM-GROUP METALS
J. I. W. Watterson, R. V. Robert, and E. Van Wyk 3 Sep. 1970 7 p refs
(NIM-1048) Avail: AEC Depository Libraries

A combined neutron activation and radioactive tracer technique was developed for study of the losses of iridium in the fire assay method for determination of the platinum group metals when lead is used as the collector. It was found that the losses during the fusion stage are small, but a large loss occurs during the cupellation stage. Author (NSA)

N71-38343# Atomic Energy Establishment, Winfrith (England).
EXPERIENCE IN THE USE OF THERMOLUMINESCENT DOSIMETERS FOR RADIATION DOSE CONTROL PURPOSES
H. E. Preston, J. J. Clifton, and C. D. Hallett Mar. 1971 8 p refs Presented at 2d Congr. of the Intern. Radiation Protection Assoc., Brighton, Engl., 3-8 May 1970
(AEEW-M-962; Conf-700506-26) Avail: AEC Depository Libraries

In situations where doses to personnel must be controlled on a short term basis due to high levels of exposure, TLD dosimeters, using thermoluminescent lithium fluoride, with their rapid readout procedure, provide a useful method of dosimetry. Some results obtained in a variety of radiation environments are reported including soft X-rays and high energy gamma and beta rays. NSA

N71-38344# Atomic Energy Establishment, Winfrith (England).
PROBLEMS OF HIGH TEMPERATURE ANNEALING OF PTFE/LITHIUM FLUORIDE DISCS USED FOR IONISING RADIATION DOSIMETRY
H. E. Preston Apr. 1971 10 p refs
(AEEW-M-991) Avail: AEC Depository Libraries

The recommended annealing procedure for PTFE/LiF dics differs from that of LiF powder, due to the nature of PTFE. The maximum temperature to which PTFE may be raised during annealing is said to be 300 C. However, at this temperature the sensitivity of discs to ionizing radiation decreases with use. By annealing at 400 C, in the same way as with powder, not only is the sensitivity of the discs enhanced, but it remains constant over many read/anneal cycles. Author (NSA)

N71-38345# European Organization for Nuclear Research, Geneva (Switzerland).
COMPILATION OF CROSS SECTIONS. 4: PION(PLUS) INDUCED REACTIONS
E. Flaminio, J. D. Hansen, D. R. O. Morrison, and N. Tovey Sep. 1970 120 p refs
(CERN-HERA-70-5) Avail: AEC Depository Libraries

A compilation of cross section of reactions produced by positive pions on targets of protons, neutrons and deuterons is presented. Graphs of the variation of cross section with incident laboratory momentum are plotted. Values for the rate of decrease of cross section with incident momentum are given. Author (NSA)

N71-38346# National Inst. of Radiological Sciences, Chiba (Japan).
RADIOACTIVITY SURVEY DATA IN JAPAN
Nov. 1970 18 p
(NIRS-RSD-29) Avail: AEC Depository Libraries

The data include radioisotope content of air-borne dusts during 1969 and 1970; Sr-90 and Cs-137 content of raw and treated waters and standard and total diets during 1969 and 1970; and the Sr-90, Ru-106, . Cs-137, contents of river sediments and soils during 1969. Also included in this report are data on the gross beta-radioactivity in rain and dry fallout and in the upper atmosphere following the eleventh nuclear test of the People's Republic of China in October 1970. All data are presented in tabular form. NSA

N71-38347# Central Electricity Generating Board, Berkeley (England). Berkeley Nuclear Labs.
SOLUBILITY OF COPPER IN SODIUM
H. E. Evans and W. R. Watson Feb. 1971 9 p refs
(RD/B/N-1901) Avail: AEC Depository Libraries

A study of the solubility of copper in sodium using a neutron activation technique provided solubility values of S sub Cu (ppm) of 3.7 at 385, 5.0 at 485, and 7.8 at 530 C. Evidence for the reversible adsorption of copper on stainless steel is presented. Author (NSA)

N71-38348# Toulouse Univ. (France). Faculte des Sciences.
RESPONSE OF LIQUID IONIZATION CHAMBERS TO PULSED PHOTON AND ELECTRON BEAMS. INHIBITION OF THE IONIZATION CURRENT BY ELECTRONEGATIVE COMPOUNDS [REPONSE AE CHAMBRES D'IONISATION A LIQUIDE DANS DES FAISCEAUX PULSES DE PHOTONS ET D'ELECTRONS. INHIBITION DU COURANT D'IONISATION PAR DES COMPOSES A CARACTERE ELECTRONEGATIF]
Robert Grob (Ph.D. Thesis) 1971 101 p refs In FRENCH; ENGLISH Summary
(NP-19875) Avail: AEC Depository Libraries

The ionization produced in certain dielectric liquids, particularly alkanes, by gamma radiation from Co-60 and the inhibition of this ionization by electron scavengers were investigated. Values for free ions produced at zero field per 100 eV absorbed and for parameters concerning the mean thermalization were calculated using Onsager theory. These parameters explain the inhibition phenomena and can be used to introduce an electronegativity classification for the scavenger products used. A difference was observed between the behavior of alkanes and benzene. Values for energy necessary to create an ion pair in the dielectric are discussed. The collection efficiency f for ionization chambers filled with these dielectric liquids was investigated using pulsed or continuous beams. It is shown that for a short intense pulse f = log (1 + U), according to the Boag formula. The ionization due to a monoenergetic 32 MeV electron beam was measured as a function of depth in a Plexiglass phantom. Liquid ionization chambers were particularly useful in measuring the surface yield. NSA

N71-38348# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Moscow (USSR). Inst. Teoreticheskoi i Eksperimentalnoi Fiziki.
DECK'S EFFECT IN THE REACTION PION(MINUS) PROTON YIELDS RHO(0) MESON PION(MINUS) PROTON AT 4.45 GeV/c
G. V. Bekatov, S. M. Zombkovskii, A. B. Kaidalov, B. S. Konovalov, S. P. Krunchinin et al 1970 23 p refs In RUSSIAN (ITEF-790) Avail: AEC Depository Libraries

The reaction was studied in a 50 cm liquid hydrogen bubble chamber. The pion proton effective mass distribution for absolute value of t sub rho less than 0.5 (GeV/c) squared (where t is a squared four momentum transfer to rho meson) has a maximum in an A(1) meson region. The distribution is in good agreement (in absolute values) with the calculated results through a Regge pion-pole exchange model. The pion proton effective mass distribution for events with absolute value of t sub rho greater than 0.5 (GeV/c) squared is well described by a phase space invariant curve added to a Breit-Wigner curve. For events from the reaction pion(minus) proton yields rho (0) meson pion proton with absolute value of t less than 0.5 (GeV/c) squared, the angular distribution of the system in an A(1) meson mass region is in agreement with the expected one for the particle decay with quantum numbers J(P) = I(+) and for the angular distribution calculated through a Regge pion-pole exchange mode. Author (NSA)

N71-38350# Atomic Energy Commission Research Establishment, Lucas Heights (Australia).
NEW METHOD OF INTERPRETING THE RESULTS OF GAMMA LOGGING OF BOREHOLES
R. Roesler 1969 12 p refs Transl. into ENGLISH from At. Energ. (Moscow), no. 26, 1969 p 337-340
(CSIRO-Trans-10088) Avail: AEC Depository Libraries

The problem of determining the content of radioactive elements in individual layers is reduced to the solution of an infinite system of equations. The calculation can be effected by the use of inverse matrix coefficients from counting rates at points equidistant from each other. The solving ability thus is dependent on the minimum thickness of elementary layers for which there still exists an inverse matrix. Interpretations of the results of gamma-logging using this method are given. They are considered particularly applicable to potassium deposits because it is not necessary to account for radioactive equilibrium; the method was also shown to be efficient for uranium. NSA

N71-38351# Joint Inst. for Nuclear Research, Dubna (USSR).
POSSIBILITIES OF OBSERVATION OF MAGNETIC SURFACE MODES USING INELASTIC NEUTRON SCATTERING
G. Heber and K. Elk 1971 10 p refs
(JINR-E2-5766) Avail: AEC Depository Libraries

Possibilities are discussed of observing surface magnons. From consideration of the cross section and transition probabilities of the neutron spin, it is concluded that the inelastic neutron scattering with special experimental conditions gives such possibilities. Thin layers, total reflection, spin depolarization, and influence of surface anisotropy are considered. Author (NSA)

N71-38352# European Organization for Nuclear Research, Geneva (Switzerland). High-Energy Reaction Analysis Group.
A COLLECTION OF PION PHOTOPRODUCTION DATA. 1: FROM THE THRESHOLD TO 1.5 GeV
P. Spillantini and V. Valente 6 Jun. 1970 155 p refs
(CERN-HERA-70-1) Avail: AEC Depository Libraries

A complete and computerized collection of pion photoproduction data on differential cross sections, recoil polarization, and asymmetry ratio with polarized gamma rays from threshold to 1.5 GeV is presented. NSA

N71-38353# Paris Univ., Orsay (France). Laboratoire de l'Accelerateur Lineaire.
MEASUREMENT OF THE RATIO OF POSITRON-PROTON AND ELECTRON-PROTON ELASTIC SCATTERING CROSS SECTIONS AT 180 DEG AT LARGE q(2) [MESURE DU RAPPORT DES SECTIONS EFFICACES DE DIFFUSION ELASTIQUE POSITRON-PROTON ET ELECTRON-PROTON A 180 DEG A GRAND TRANSFERT]
B. Bouquet (Ph.D. Thesis) Apr. 1971 117 p refs In FRENCH
(LAL-1251) Avail: AEC Depository Libraries

The real part of the amplitude of elastic scattering of electrons and positrons on protons with several photons exchanged was measured, and the results are given for energies of 380 and 980 MeV at 180 deg. The ratio of cross sections of positron to electron scattering was found to be 1.038 + or - 0.016 at 400 MeV and 1.058 + or - 0.05 at 1 GeV. NSA

N71-38354# Paris Univ. (France). Faculte des Sciences.
KAON(MINUS)d AND KAON(MINUS)n INTERACTIONS AT ABOUT 1 GeV/c
Jean-Louis Narjoux (Ph.D. Thesis) 1970 147 p refs In FRENCH
(NP-18891) Avail: AEC Depository Libraries

K(-)d yields K(-)d and K(-)n yields K(-)n interactions were studied in the 1 GeV/c region. Cross sections and angular distributions were measured. They are in good agreement with the simplified model of Bertocchi. The study of the K(-)d yields p proton Lambda hyperon pion(-) reaction enabled the validity of the impulse approximation for K(-)d interactions at these energies to be established. A method for identifying the spectator nucleon was developed in the framework of this approximation. In events involving a diassociated deuteron in the final state, two samples were isolated, one with a neutron spectator, the other with a proton spectator. In the case of a neutron spectator the results obtained for the elastic K(-)p reaction are in good agreement with previous results. The method enabled the K(-)n yields K(-)n angular distribution to be determined directly in the angular interval -1 to 0.7. Experimental results with hydrogen are in agreement with the T= I scattering amplitude. NSA

N71-38355# Paris Univ., Orsay (France). Faculte des Sciences.
THE (d, He-3) REACTION WITH Bi-209 AT 80 MeV AND THE EVEN LEAD ISOTOPES. CONTRIBUTION TO THE STUDY OF THE PHENOMENOLOGICAL NUCLEAR POTENTIALS OF Pb-208
Denis Royer 1971 58 p refs In FRENCH
(NP-18878) Avail: AEC Depository Libraries

The reactions Pb-204(d,He-3), Pb-206(d,He-3), and Bi-209(d,He-3) were studied using the 80 MeV deuteron beam of the synchrocyclotron. The results obtained for the reactions Pb-208(d,He-3)Tl-207 and Bi-209(d,He-3)Pb-208 and also Pb-204(d,He-3)Tl-203 and Pb-206(d,He-3)Tl-205 (angular momentum and excited states) are compared. The single particle states and the phenomenological potentials of Pb-208 are studied. Author (NSA)

N71-38356# Atomic Energy of Canada, Ltd., Chalk River (Ontario). Nuclear Labs.
NUCLEAR AND SOLID STATE PHYSICS RESEARCH
30 Sep. 1970 103 p
(AECL-3742; PR-P-67) Avail: AEC Depository Libraries

Research progress in the period July 1 through September 30, 1970, is summarized. The programs of the nuclear physics branch, the general physics branch, the neutron physics branch, the theoretical physics branch, and the mathematics and computation branch are briefly described. NSA

N71-38357# Paris Univ., Orsay (France). Faculte des Sciences.
ANALYSIS OF THE KAON(MINUS) PROTON YIELDS LAMBDA(0) HYPERON PION(PLUS) PION(MINUS) REACTION AND THE SEPARATION OF THE KAON(MINUS) PROTON INTERACTIONS FROM THE KAON(MINUS) NUCLEUS INTERACTIONS IN A HEAVY LIQUID BUBBLE CHAMBER [ANALYSE DE LA REACTIN KAON(MINUS)

PROTON YIELDS LAMBDA(0) HYPERON PION(PLUS) PION(MINUS) ET ETUDE DE LA SEPARATION DES INTERACTIONS KAON(MINUS) PROTON NOYAU DANS UNE CHAMBRE A BULLES A LIQUIDE LOURD]
A. Ferrer-Soria (Ph.D. Thesis) Mar. 1971 73 p refs In FRENCH
(LAL-RI-71-2) Avail: AEC Depository Libraries

The formation of baryon resonances in the kaon(-) proton interaction around 1660 MeV in the center of the mass system, and their decay into various neutral channels were studied in a bubble chamber. The reaction kaon(-) proton yields Lambda(0) hyperon pion(+) pion(-) was analyzed in order to determine the possibility of separating kaon(-) proton interactions from kaon(-) nucleus interactions and to estimate the corresponding background. Mean life measurements on Lambda(0) hyperon and reaction cross section calculations revealed the presence of hyperon(-) and hyperon(+) resonances. It was thus proven that the separation of kaon(-) proton interactions from kaon(-) nucleus interactions is possible. NSA

N71-38368# Commissariat a l'Energie Atomique, Saclay (France). Dept. d'Electronique Generale.
MEASUREMENT OF Rb-89 GAMMA RAY ENERGIES [MESURE DES ENERGIES GAMMA DU RUBIDIUM 89]
Jean-Pierre Bocherniih, Roger Le Meur, and Christiane Poux 18 Mar. 1971 10 p refs In FRENCH
(CEA-N-1444) Avail: AEC Depository Libraries

Gamma radiation lines of Rb 89 from fission products on a filter were measured. A Ge(Li) detector and a 4,000 channel analyzer were used in the measurements. The relative abundances and the half lives were calculated. The possibility of a mutual interaction between the photoelectric peaks and the resonance escape lines is examined. An order of magnitude for the detection threshold is given for the installation. NSA

N71-38369# United Kingdom Atomic Energy Authority, Harwell (England).
STUDY OF THE NUCLEI N-12, F-16, Mg-22, Si-26, AND S-30 BY (He-3,n) REACTIONS
J. M. Adams, A. Adams, and J. M. Calvert Feb. 1971 38 p refs
(AERE-R-6473) Avail: AEC Depository Libraries

Fast neutron time-of-flight techniques were used to study the five proton-rich nuclei N-12, F-16, Mg-22, Si-26, and S-30 by means of (He-3,n) reactions. In all cases the ground-state reaction Q values, the mass of the residual nuclei, and the low-lying level structure of the residual nuclei were determined to a fairly high accuracy. Angular distributions were measured for the three neutron groups corresponding to excitation of the first three levels in N-12 for the B-10(He-3,n)N-12 reaction at 2.4, 2.75, and 2.94 MeV incident energies. The neutron group 0 deg excitation functions corresponding to these levels were measured between 1.73 MeV and 3.19 MeV. The ground- and first-excited-state neutron-group angular distributions for the Ne-20(He-3,n)Mg-22 reaction were measured at an incident energy of 3.045 MeV. The ground-state neutron-group angular distribution for the Mg-24(He-3,n)Si-26 reaction was measured at an incident energy of 3.14 MeV. Author (NSA)

N71-38380# Paris Univ. (France). Faculte des Sciences.
CONTRIBUTION TO THE STUDY OF SURFACE REACTIONS BETWEEN MEDIUM-MASS-TARGET NUCLEI (Ag) AND HEAVY PROJECTILES (C,N) [CONTRIBUTION A L'ETUDE DE REACTIONS DE SURFACE ENTRE NOYAUX-CIBLE DE MASSE MOYENNE (Ag) ET PROJECTILES LOURDS (C,N)]
Joel Galin (Ph.D. Thesis) 1971 93 p refs In FRENCH
(NP-18874) Avail: AEC Depository Libraries

The mechanism of the surface reactions occurring between medium-mass target nuclei (Ag) and heavy projectiles (C,N) was studied. The experiment was performed with the C-12 and N-14 beams of the cyclotron; the N-14 nuclei were accelerated to 78 MeV and 113 MeV. The mass balance of the reaction was investigated for the Ag-107 and Ag-109 isotopes of the target. Sixteen nuclei was detected from the system (C-12 + Ag) and nineteen from the system (N-14 + Ag). The angular distributions for each of these products were established as well as the energy spectra in each measurement direction. The cross sections relating to two possible mechanisms were calculated. The critical angular momentum limiting the formation of a compound nucleus was calculated. NSA

N71-38381# Ottawa Univ. (Ontario).
EXCITATION OF BOUND ATOMIC STATES BY A SUDDEN CHANGE OF CENTRAL FIELD RESULTING FROM BETA(MINUS) DECAY
H. Juergen Andree Ottawa, Canada Natl. Res. Council 1971 29 p refs Transl. into ENGLISH from Z. Phys. (West Germany), v. 215, 1968 p 279-301
(NRC-TT-1455) Avail: AEC Depository Libraries

By the sudden change of nuclear charge during beta(-) decay the daughter ion is ionized or excited with probabilities of the order of some percent; other processes in the electron shell may be neglected, and therefore unperturbed excitations can be measured by detecting photons emitted from the decaying excited atomic states in delayed coincidence with beta(-) particles as is shown in an earlier paper for the Kr-85-beta(-) decay. More extensive measurements of the photon emission after this decay give results in good agreement with theoretical predictions. Mostly such photons are observed, which can be emitted after a monopole excitation. The total excitation probability into both 5p(J = 0) states of Rb II is found to be P(4p - 5p) = 5.6 + or - 1.0%. The lifetimes of these two states are measured. Author (NSA)

N71-38382# European Organization for Nuclear Research, Geneva (Switzerland).
PHASE MOTION OF THE HIGH INTENSITY BEAM OF THE STRONG-FOCUSING SEPUKHOV PROTON SYNCHROTRON
P. T. Peshkov et al 1971 10 p refs Transl. into ENGLISH from Russian rept. IFVE-SKU-70-15
(CERN-Trans-71-3; IFVE-SKU-70-15) Avail: AEC Depository Libraries

The influence of a space charge on the beam phase movement in the strong-focussing proton synchrotron has been studied. The solution of the phase equation taking into account the influence of the electrical self-field of the bunches in case of nonlinear synchrotron oscillations has been obtained. The numerical calculations have been made by analog computer. Author (NSA)

N71-38383# European Organization for Nuclear Research, Geneva (Switzerland).
COMPILATION OF TOTAL AND TOTAL ELASTIC CROSS SECTIONS
G. Giacomelli 2 Dec. 1969 35 p refs
(CERN-HERA-69-3) Avail: AEC Depository Libraries

A computerised collection of total, total elastic and total charge exchange data on hadron-nucleon scattering is presented. Also given are interpolated values of the data. Author (NSA)

N71-38384# Kernforschungszentrum, Karlsruhe (West Germany). Institut fuer Radiochemie.
SPECIFIC ENERGY LOSS AND EFFECTIVE CHARGE OF FISSION PRODUCTS IN METAL ABSORBERS [SPEZIFISCHER ENERGIEVERLUST UND EFFEKTIVE LADUNG VON SPALTPRODUKTEN IN METALLISCHEN ABSORBERN]
Helmut Albrecht Mar. 1971 61 p refs In GERMAN; ENGLISH summary
(KFK-1389) Avail: AEC Depository Libraries

The specific energy loss of fission fragments was measured by placing different Al, Ni, Ag, and Au foils between a Cf-252 fission source deposited on an extremely thin backing and a semiconductor detector. The thickness range of the foils was 0.1 to 2.0 mg sq cm. By using a second detector, placed on the

reverse side of the fission source, it was possible to measure the energy as well as the mass of the fission fragments. The energy and mass ranges covered were 0.4 to 1.1 MeV/amu and 90 to 150 amu, respectively. The effective charge was determined by deflection of the fragments in a magnetic field. This measurement was carried out in order to investigate whether or not Bohr's classical theory might be applied to the slowing down of the fission fragments. The result was that the equation of Bohr does not hold, even when the shell correction terms are considered. The calculation of the effective charge for gaseous absorbers can be carried out using the Thomas-Fermi model of the atom.
Author (NSA)

N71-38365# Joint Inst. for Nuclear Research, Dubna (USSR).
THREE-QUASIPARTICLE EXCITATIONS IN At-205
U. Hagemann, W. Neubert, L. K. Peker, and F. Stary 1971 8 p refs
(JINR-E6-5802) Avail: AEC Depository Libraries
In the reaction Au-197(C-12, 4n)At-205 an isomeric state with a half-life T 1/2 = 110 + or - 25 nsec, belonging to the p(h 9/2)3 configuration, was observed. Author (NSA)

N71-38366# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.
CONCLUSIONS ON THE STRUCTURE OF THE Gd-153 STATES DRAWN FROM THE RESULTS OF THE LIFETIME MEASUREMENTS
Ya. Vavryshchuk, A. F. Novgorodov, V. A. Morozov, T. M. Muminov, V. I. Razov et al 1970 16 p refs In RUSSIAN
(JINR-P6-5526) Avail: AEC Depository Libraries
The half-lives of the Gd-153 levels were measured by using the delayed gamma-gamma and e-gamma coincidences method. Rotational band transition probabilities were calculated. The results are discussed in the framework of the Nilsson single-particle model. Author (NSA)

N71-38367# United Kingdom Atomic Energy Authority, Harwell (England).
MEASUREMENT OF THE RATIO ALPHA OF RADIATIVE-CAPTURE AND FISSION CROSS-SECTIONS FOR Pu-239 IN THE ENERGY RANGE OF NEUTRONS 0.1-30 keV
V. N. Kononov et al Aug. 1971 11 p refs Transl. into ENGLISH from Russian rept. JINR-P3-5112
(LB/G-2876; JINR-P3-5112) Avail: AEC Depository Libraries
The ratio alpha of the radiative capture and fission cross sections for plutonium-239 was measured by the time-of-flight method in the neutron energy range 0.1 - 30 keV and with a resolution of 15 and 220 ns/m. Author (NSA)

N71-38368*# Texas Christian Univ., Fort Worth.
RADIATIVE INTERACTIONS OF ELECTRONS WITH MATTER Final Report
C. A. Quarles Sep. 1971 34 p refs
(Contract NASS-24658)
(NASA-CR-119957) Avail: NTIS CSCL 20I
Experimental techniques were developed and applied to the study of inner shell ionization by electrons, bremsstrahlung production by electrons, and electron scattering from a wide variety of targets in the energy range up to 140 keV. The equipment and research capabilities developed are described and the results of experiments performed are presented. A list of the dissertations and publications resulting or expected from this effort is included. Author

N71-38369# Ence Neutron Data Compilation Centre, Gif-Sur-Yvette (France).
[CROSS SECTION DATA FOR NEUTRON RADIATION CAPTURE AND LEAD. NEWSLETTER BULLETIN NO. 10]
Dec. 1969 142 p refs
(CCDN-NW-10) Avail: AEC Depository Libraries
A semi-empirical evaluation of fast neutron radiative capture cross sections of 32 less than or equal to z less than or equal to 66 stable nuclei is presented. A survey of total cross-section measurements for lead below 100 keV, and a list of the data available on antineutrino for Cf-252 in the CCDN data library are also included. NSA

N71-38370*# Oak Ridge National Lab., Tenn. Neutron Physics Div.
LOW-ENERGY ELECTRON TRANSPORT WITH THE METHOD OF DISCRETE ORDINATES
D. E. Bartine, R. G. Alsmiller, Jr., F. R. Mynatt, W. W. Engle, Jr., and J. Barish 22 Feb. 1971 9 p refs Presented at the Nat. Symp. on Natural and Manmade Radiation in Space, Las Vegas, Nevada, 1-5 Mar. 1971
(NASA Order H-38280A)
(NASA-CR-123118; ORNL-TM-3318; Conf-710304-4) Avail: NTIS CSCL 20H
The one-dimensional discrete ordinates code ANISN was adapted to transport of low-energy (about equal to a few MeV) electrons. Calculated results obtained with ANISN are compared with experimental data for the transmitted electron energy and angular distributions for 1-MeV electrons normally incident on aluminum slabs of several thicknesses. The calculated and experimental results to date are in good agreement for a thin slab (0.2 of the electron range) but are not in good agreement for thicker slabs (0.6 of the electron range). Calculated results obtained with ANISN are also compared with calculated results obtained using Monte Carlo methods. Author (NSA)

N71-38371# Rennes Univ. (France). Faculte des Sciences.
CONTRIBUTION TO THE STUDY OF ELECTROSTATIC SEPARATION OF HIGH-ENERGY PARTICLES: TWO PLATE AND MULTIPLE-PLATE SEPARATORS [CONTRIBUTION A L'ETUDE DE LA SEPARATION ELECTROSTATIQUE DES PARTICULES DE HAUTE ENERGIE: SEPARATEURS A DEUX PLAQUES ET A PLAQUES MULTIPLES]
D. J. Simon (Ph.D. Thesis) 1971 146 p refs In FRENCH
(NP-18788) Avail: AEC Depository Libraries
Two methods for particle separation by means of deflectors with crossed electric and magnetic fields are considered. The action of the two-plate separator on the trajectory of the particles crossing it is summarized. Beam behavior is studied by considering individual trajectories using the concept of track space. The optima of the principal parameters of the system were determined as a function of the incident beam geometry. Transmission of the particles desired and contamination due to Coulomb scattering of particles which touch the plates were studied simultaneously. The representations in the track space were used to study the optical performances of the two types of separators. The separators were compared on the basis of the high voltage performance obtained with the test separators. Applications and limitations are discussed. Author (NSA)

N71-38372# Academy of Sciences of the Ukranian SSR, Kiev (USSR). Inst. Teoreticheskoi Fiziki.
ELECTROMAGNETIC INTERACTIONS: THEORY
L. D. Solovev 1971 60 p refs Presented at the 15th Intern. Conf. on High Energy Phys., Kiev, 26 Aug. 1970
(ITF-71-5-E; Conf-700806-59) Avail: AEC Depository Libraries
A review is given of new theoretical results on quantum electrodynamics in higher orders at low and high energies and in models, lepton-hadron scattering for the deep inelastic scattering of electrons on nucleons and the form factors of elastic scattering, and photon-hadron Compton scattering. NSA

N71-38373# Academy of Sciences of the Ukranian SSR, Kiev (USSR). Inst. Teoreticheskoi Fiziki.
ON THE PTC-NON-INVARIANT LAGRANGIANS
V. I. Fushchich 1971 7 p refs In RUSSIAN
(ITF-71-2-P) Avail: AEC Depository Libraries
The Lagrangians which are noninvariant under the PTC-transformations are constructed by the Casimir operators

(the energy sign and helicity) of the proper Poincare group.
Author (NSA)

N71-38374# Academy of Sciences of the Ukranian SSR, Kiev (USSR). Inst. Teoreticheskoi Fiziki.
ON TWO-COMPONENT EQUATIONS FOR ZERO MASS PARTICLES
V. I. Fushchich and A. L. Grishchenko 1970 22 p refs
(ITF-70-88-E) Avail: AEC Depository Libraries

A theoretical-group analysis of three types of two-component equations of motion which describe the particle with zero mass and spin 1/2 are presented. The P-, T-, and C-properties of the equations obtained are studied. Author (NSA)

N71-38375# Royal Inst. of Tech., Stockholm (Sweden).
GROUP THEORETICAL ANALYSIS OF TRIGONAL SELENIUM ENERGY BANDS
Eero Sucsara 1970 51 p refs
(PB-197640; APS-PH-72) Avail: NTIS CSCL 20L

The work contains the group theoretical knowledge of selenium energy bands. It contains the degeneracies, obligatory slopes, possible band structures at symmetry axes of the reciprocal space, and possible locations and symmetries of band gap extrema both for nonrelativistic and for relativistic bands. Optical transition possibilities are given. Author (GRA)

N71-38376# Brown Univ., Providence, R.I. Dept. of Physics.
DISCONTINUITY FORMULAE AND A DERIVATION OF MUELLER'S REGGE HYPOTHESIS FOR INCLUSIVE CROSS SECTIONS
Chung I. Tan [1971] 27 p refs Sponsored in part by AEC
(NYO-2262-TA-240) Avail: NTIS

Interpretation of recent work on inclusive cross sections in terms of the elementary discontinuity equations for multi-particle scattering amplitudes is proposed. The paths of continuity for obtaining these discontinuities are given. It is found that, in order to make the identification meaningful, the emergence of anomalous thresholds is necessary to shield the effects of box diagram Landau singularities. It is demonstrated how Mueller's Regge hypothesis can be derived from the multi-Regge models, where singularities other than normal thresholds are absent in the asymptotic limits. Author (NSA)

N71-38377# Brown Univ., Providence, R.I.
INTERPRETATION OF A LARGE VALUE OF THE NUCLEON SIGMA COMMUTATOR
R. Olshansky [1971] 5 p refs Sponsored in part by AEC
(NYO-2262-TA-243) Avail: NTIS

It is proposed that the value of the nucleon sigma commutator, nucleon-nucleon cross section calculated from pion N scattering data be used to determine what part of the average baryon mass is due to the chiral symmetry-breaking interaction. In the (3,3*) +(3*,3) model the large value of nucleon-nucleon cross section then implies that the baryon mass vanishes in the SU(3) x SU(3) limit. Study of a Lagrangian model shows that this possibility need not conflict with the symmetry breaking Hamiltonian. Author (NSA)

N71-38378# Brown Univ., Providence, R.I. Dept. of Physics.
CHIRAL SYMMETRY BREAKING OF THE VACUUM
R. Olshansky [1971] 9 p refs Sponsored by AEC
(NYO-2262-TA-242) Avail: NTIS

The chiral symmetry breaking of the vacuum is studied in the linear sigma model. It is found that an approximately SU(3) symmetric vacuum can explain the observed spin-zero mass spectrum, the quantity, and the mass splitting of the baryon octet. The results support a previous conclusion that the symmetry breaking Hamiltonian possesses approximate SU(2) x SU(2) symmetry. The detailed structure of the Lagrangian favors the Goldstone realization of full SU(3) x SU(3) symmetry.
Author (NSA)

N71-38379# California Univ., Livermore. Lawrence Radiation Lab.
SENSITIVITY OF MONTE CARLO CALCULATIONS TO THE NEUTRON CROSS SECTIONS FOR NEUTRON TRANSPORT IN NITROGEN AND IN AIR
Luise F. Hansen, John D. Anderson, John L. Kammerdiener, and Calvin Wong 22 Mar. 1971 24 p refs
(Contract W-7405-eng-48)
(UCRL-51031) Avail: NTIS

The predictions of the SORS Monte Carlo calculations for neutron transport from a 14 MeV neutron source in nitrogen and in air are compared using different libraries for nitrogen. In turn, these libraries are tested against experimental measurements for the integral neutron spectra between 0.5 and 10 mfp at 14 MeV. The measured neutron spectra cover a neutron energy range between 1 eV and 14 MeV. The neutron library for oxygen is checked against measurements for 0.72 mfp at 14 MeV for neutron energies between 30 KeV and 14 MeV. It is found that features of neutron transport at 14 MeV are mainly determined by the neutron cross sections at neutron energies close to the source energy. Neutron fluence as a function of neutron energy at a given distance from the source is, however, more sensitive to the neutron cross sections at energies below 14 MeV. This sensitivity is most pronounced at great distances from the neutron source. Author (NSA)

N71-38380# California Univ., Richmond.
[EXPERIMENTAL AND THEORETICAL RESEARCH ON HIGH-ENERGY PHYSICS] Annual Report
A. Kerman and R. T. Poe May 1971 23 p refs
(Contract AT(04-3)-34)
(UCR-34-P-107-B-124) Avail: NTIS

Both experimental and theoretical research on high-energy physics is summarized. A list of publications issued during the period is included. NSA

N71-38381# Du Pont de Nemours (E. I.) and Co., Aiken, S.C. Savannah River Lab.
CALCULATED ENHANCEMENT OF THERMAL NEUTRON FLUX FROM A Cf-252 SOURCE
F. J. McCrossen May 1971 23 p refs
(Contract AT(07-2)-1)
(DP-1250) Avail: NTIS

The thermal neutron flux obtainable from a Cf-252 neutron source in a moderated subcritical multiplying system was studied by means of the ANISN code. The dependence of the flux on sub eff of the system, the sigma sub aeff of the system, the ratio of fissionable material to purely absorbing material, and the type of moderating material are discussed. Two group analytic solutions are presented to show the approximate dependence of the flux on the various parameters. Multiplying media and nonmultiplying media are compared. Author (NSA)

N71-38382# Idaho Nuclear Corp., Idaho Falls.
SOME PROBLEMS ENCOUNTERED PROCESSING ENDF/B DATA WITH ETOG AND ETOP
R. A. Grimesey and G. L. Singer 1971 6 p refs Presented at Meeting on New Develop. in Reactor Math. and Appl., Idaho Falls, Idaho, 29 Mar. 1971
(Conf-710302-3) Avail: NTIS

The program package ETOP, a variation of ETOG to fit the PHROG code theory, was used to process ENDF/B data files. Some of the problems encountered in this work are discussed. NSA

N71-38383# Virginia Univ., Charlottesville.
[ON EXPERIMENTS ON NUCLEAR INTERACTIONS OF PIONS] Progress Report
J. S. McCarthy, R. C. Minehart, S. E. Sobottka, and K. O. H. Ziock May 1971 10 p refs
(Contract AT(40-1)-4043)
(ORO-4043-2) Avail: NTIS

Data gathering on pion scattering from O2 is now completed, and the data are being analyzed. An experiment to measure the yields and angular distributions in the(negative pion, np), (negative pion, nd) and (negative pion, nt) reactions in O2 was successfully carried out. The (positive pion, 2p) and (positive pion, p) experiments performed are now in the data analysis phase. Measurements on the muon kinetic energy in pion(+) decay were completed and the data are being analyzed to obtain a better upper limit on the muon neutrino rest mass. Work is proceeding on a liquid He target for studies of pion(-) capture in He-4. A collaboration with LAMPF is carried out on the design of the magnetic spectrometer and detector system for EPICS, the high resolution pion scattering facility. The EPICS working group is participating in the development of beam monitoring equipment, computer programming and detector design.

Author (NSA)

N71-38384# Texas Univ., Austin.
SOME CONSEQUENCES OF A PIECEWISE ANALYTIC SCATTERING AMPLITUDE
M. G. Gundzik and E. C. G. Sudarshan Apr. 1971 35 p refs
(Contract AT(40-1)-3992)
(ORO-3992-52) Avail: NTIS

The physical two body scattering amplitude G(s,t) is investigated. The modified forms of the Pomeranchuk theorem, dispersion relations and finite energy sum rules due to this general form of piecewise analyticity are derived and the interpretation of experimental results in terms of them are discussed. In particular, the modified forward dispersion relations for pion(+) proton and pion(-) proton scattering differ from the normal forms by a function which depends on the piecewise analytic contributions. The forward dispersion relations for the symmetric and antisymmetric combinations of the real part of the pion(+) proton and pion(-) proton scattering amplitudes positive D(nu) and negative D(nu), respectively, are tested. The best fits to the latest total cross section data for pion(+,-) proton scattering from 8 to 65 GeV/c which do not satisfy the Pomeranchuk theorem are used. No test for negative D(nu) which must be twice subtracted is possible since it depends strongly on the pion Neutron coupling constant f2 which is itself determined by dispersion relations. The result for positive D(nu) allows for a violation, but the evidence is not compelling.

Author (NSA)

N71-38385# Battelle-Northwest, Richland, Wash.
ENERGY TRANSFER TO ELECTRONS IN FAST PROTON COLLISIONS
L. H. Toburen and W. A. Glass 28 Apr. 1971 18 p
(Contract AT(45-1)-1830)
(BNWL-SA-3953; Conf-710508-2) Avail: NTIS

Measurements were made of the energy and angular distributions of electrons ejected by impact of fast protons on thin gas targets. Cross sections for energy transfer to electrons were obtained. The effect of increasing the complexity of the target molecule is pointed out by comparison of results for protons on H2 and on N2. The interaction of protons with more complex molecules yields a wider spread in the angular distribution of energy transfer. For molecules having inner electronic shells, electrons ejected from the outer shells result in energy transfer distributions similar to those from hydrogen, and the more tightly bound electrons contribute to energy transfer in a more forward direction. In both H2 and N2 the angular dependence of the energy transfer to electrons is a strong function of the incident proton energy. NSA

N71-38386# Brown Univ., Providence, R.I. Metcalf Chemical Lab.
KINETIC ENERGIES OF IONIZATION PRODUCTS FROM COLLISIONS OF Ar-Ar, He-He BELOW 220 eV c.m. ENERGY
R. H. Hammond, J. M. S. Henis, E. F. Greene, and John Ross (MIT, Cambridge) [1970] 31 p refs Sponsored in part by AEC, NSF and Navy
(NYO-2101-27) Avail: NTIS

Measurements were made of the energy spectra of ions and electrons produced in the collision of beams of neutral Ar of given energy (laboratory energy range 57 to 240 eV) with a gas of Ar and of neutral He (145 to 300 eV) with a gas of He. The energy dependence of the total cross section for ionization was consistent with previous results. The electron spectra from Ar-Ar collisions showed peaks at 0, 6, and approximately 9 eV. From this it was estimated that about 15% of the Ar(+) ions produced come from autoionizing states of Ar. For certain ranges of initial relative energy Ar-Ar ionization occurs mostly in backscattering collisions. An analysis of the ion spectra of experiments at these initial relative energies (greater than 33 eV), made with a simple model, shows that most ions are produced by two curve crossings 12 + or - 2 and 22 + or - 1 eV above the ionization potential (15.8 eV).

Author (NSA)

N71-38387# Idaho Nuclear Corp., Idaho Falls.
DESTRUCTIVE EXAMINATION OF A HALLAM NUCLEAR POWER FACILITY INTERMEDIATE HEAT EXCHANGER
W. L. Random Apr. 1971 52 p
(Contract AT(10-1)-1230)
(IN-1477) Avail: NTIS

One Hallam Nuclear Power Facility intermediate heat exchanger was disassembled and the components metallurgically examined by the Idaho Nuclear Corporation at Test Area North of the AEC National Reactor Testing Station, located near Idaho Falls, Idaho. The major objective of the examination was to provide data for assessment of crevice corrosion problems and evaluation of operational deteriorations associated with frontface type tube-to-tubesheet weld joints for sodium-to-sodium heat exchangers. Metallurgical evaluation of the front face tube-to-tubesheet welds found the welds to be structurally sound. The presence of sodium in the tube-to-tubesheet crevice did not damage the tubes or the tubesheet since no correlation was found between sodium deposits in the crevices and tube or tubesheet ligament cracks. The examination revealed stress corrosion cracking in some tubes and ligaments of the top tubesheet but not in the bottom tubesheet. Author (NSA)

N71-38388# Los Alamos Scientific Lab., N.Mex.
LOS ALAMOS HANDBOOK OF RADIATION MONITORING
John W. Healy 1970 219 p
(Contract W-7405-eng-36)
(LA-4400) Avail: NTIS; SOD $1.25

The radiation protection program is reviewed, and methods used for radiation monitoring are described in detail. Data are included on the maximum permissible concentrations of approximately 200 radioisotopes in air and water, and data on maximum permissible body exposure are included when relevant.

NSA

N71-38389# Commissariat a l'Energie Atomique, Fontenay-Aux-Roses (France). Centre d'Etudes Nucleaires.
NUCLEAR HEATING MEASUREMENTS USING IONIZATION CHAMBERS [MESURES D'ECHAUFFEMENT D'ORIGINE NUCLEAIRE AU MOYEN DE CHAMBRES D'IONISATION]
Bertrand De Coenac, Jean Delacour, Charles Fiche, Jean-Paul Noel, and Michel Lott May 1971 56 p In FRENCH
(CEA-R-4195) Avail: AEC Depository Libraries

The use of ionization chambers to measure nuclear heating effects is described. The basic principles of ionization chambers are recalled, and various experiments for determining their sensitivities to different radiations are described. Examples are given of practical developments illustrating the flexibility of the technique. The method of calibration is also described.

Author (NSA)

N71-38390# Lyon Univ. (France). Faculte des Sciences.
STUDY OF THE REACTIONS (He-3,p) WITH B-11, N-14, AND Ne-20, AND THE EXCITED LEVELS OF Ne-21 AND

Ar-41 FROM THE Ne-20(p, GAMMA) AND Ar-40(d, p GAMMA) REACTIONS [ETUDE DES REACTIONS (HE-3, P) SUR B-11, N-14, NE-20 ET DE CERTAINS NIVEAUX EXCITES DE NA-21 ET A-41 A PARTIR DES REACTIONS NE-20(P, GAMMA) ET A-40(D, P GAMMA)]
Christian Meynadier (Ph.D. Thesis) 1970 159 p refs In FRENCH
(NP-18862) Avail: AEC Depository Libraries

A 3 Mev Van de Graaff accelerator was used in studying the (He-3,p) reactions with Ne-20, N-14, and B-11 nuclei and the gamma de-excitation of Ne-21 and Ar-41. The apparatus used and the techniques developed (reaction chamber, gaseous targets, detection systems) are described. The investigations demonstrated the predominance of compound nucleus mechanisms in the Ne-20 and B-11(He-3,p) reactions. The Hauser-Feshbeck theory predicts quite well the total experimental cross sections of the different groups in these reactions. In the N-14(He-3,p) reaction the direct interaction mechanism is dominant. An analysis using the DWBA method of the Ne-20(He-3,p sub 14) reaction led to the assigning of 1(+) characteristics to the E = 3.944 MeV level of Ne-22. The de-excitation gamma radiation from the E = 4.14 MeV Ne-22 level was established. Analysis of p, gamma correlations in the Ar-40 (d,p gamma) Ar-41 reaction confirmed the spin 1/2 of the 2.398 MeV state of A-41 and established a spin of 3/2 for the 2.734 state of this nucleus. NSA

N71-38381/ Akademiya Nauk SSSR, Novosibirsk. Inst. Yadernoi Fiziki.
TO THE QUESTION OF THE LIMITING TRANSITION TO ZERO MASS AND RENORMALIZABILITY IN THE MASSIVE YANG-MILLS FIELD THEORY
I. B. Khriplovich and A. I Vainshtein 1970 29 p refs
(NP-18859) Avail: AEC Depository Libraries

It is shown that in perturbation theory for the massive Yang-Mills field there is no continuous limiting transition to zero mass and the theory is unrenormalizable. These results are the consequence of the singularity of zero helicity (three-dimensionally longitudinal) quanta interaction, the singularity which is absent for the neutral vector field. The generalization of the radiation gauge to the nonzero mass case is built. In this description the interaction of three-dimensionally longitudinal quanta is extracted explicity. The consideration in this formalism makes extremely likely the assertion of the existence of continuous limiting transition to zero mass and of renormalizability beyond the perturbation theory. Author (NSA)

N71-38382/ Kyoto Univ. (Japan). Research Reactor Inst.
EFFECT OF PRESSURE ON THE REFLECTIVITY OF NEUTRONS BY A MONOCHROMATOR CRYSTAL
[1971] 6 p refs In JAPANESE; ENGLISH summary
(KURRI-TR-85) Avail: AEC Depository Libraries

In order to obtain neutron monochromating crystals with high reflectivities the effect of pressure on the neutron reflectivity was studied for various single crystal specimens of Cu and Ge under the various collimating conditions. The experimental data are shown as functions of the pressure, collimation, and pressure orientation Author (NSA)

N71-38383/ Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.
SHOWER EFFICIENCY OF SPARK CHAMBERS
S. M. Korenchenko, G. V. Mitselmakher, and K. G. Nekrasov 1971 12 p refs In RUSSIAN
(JINR-P13-5810) Avail: AEC Depository Libraries

A phenomenological model for developing some breakdowns in one gap of a spark chamber is suggested which takes into account the fluctuation in the streamer formation time. The shower efficiency can be determined with the help of two parameters: the efficiency of one particle recording and the counting parameter. A satisfactory agreement with experimental data is obtained. Author (NSA)

N71-38384/ Scottish Research Reactor Centre, East Kilbride.
DETAILS OF SOME BETA HEATING CALCULATIONS
J. Scoble and R. C. Scott [1971] 12 p refs
(SRRC-3871) Avail: NTIS Avail: AEC Depository Libraries

Calculations were performed of beta energy release rates following the thermal neutron induced fission of U-233, U-235, Pu-239 and Pu-241. The method of calculation is described and the input data, consisting of the independent fission yields, half-lives, average beta energies and branching ratios of the various nuclides, are tabulated. The FORTRAN 5 computer program, which enabled the calculation to be carried out on the Univac 1108 machine is listed. Author (NSA)

N71-38385/ Hahn-Meitner-Institut fur Kernforschung, Berlin (West Germany).
INVESTIGATIONS ON KNOCKOUT EFFECT: LAYER THICKNESS DEPENDENCE AND COLLISION CASCADES [UNTERSUCHUNGEN ZUM KNOCK-OUT-EFFEKT: SCHICHTDICKENABHAENGIGKEIT UND STOSSKASKADEN]
Peter Mertens Mar. 1971 53 p refs In GERMAN
(HMI-B-105) Avail: AEC Depository Libraries

Experiments and calculations are reported on the knockout effect. A catcher foil is used to measure the knockout coefficient as a function of an emitting UO2 layer's thickness. Some information about the mechanism is gained through electron microscopy of the irradiated layers. Collision cascades originating from uranium fission product are calculated in the Thomas-Fermi potential, and the knockout coefficient is estimated. Author (NSA)

N71-38386/ Institute of Nuclear Research, Warsaw (Poland).
PENETRATION OF A DOUBLE POTENTIAL BARRIER IN FISSIONING NUCLEI
J. Dudek 1970 10 p refs
(INR-P-1254) Avail: AEC Depository Libraries

The transmission coefficient is calculated for a double-humped potential V(x) which has finite limits for the absolute value of x to infinity. The potential is taken with the form of two inverted squared hyperbolic cosines joined together. Author (NSA)

N71-38387/ Akademiya Nauk URSR, Kiev. Inst. Teoreticheskoi Fiziki.
VARIATIONAL CALCULATION FOR A BOUND OF THE REGION OF EXISTENCE OF ATOMIC NUCLEI
A. I. Steshenko 1971 18 p refs In RUSSIAN; ENGLISH summary
(ITF-71-6-P) Avail: AEC Depository Libraries

The bounds of the region of existance of atomic nuclei are calculated by a variational method. The exchange central NN-potential used in calculations is chosen to satisfy the two-particle experiments at low energies and to provide the saturation condition. The obtained results agree with the known experimental data; they are also consistent with the calculations of other authors. Author (NSA)

N71-38388/ Institute of Nuclear Research, Warsaw (Poland).
EFFECTIVE FORCE FOR THE NILSSON MODEL CALCULATIONS OF THE COLLECTIVE NUCLEAR PHENOMENA
Z. Bochnacki, S. Gabrokov, and M. Zielinska-Pfabe 1970 13 p refs
(INR-P-1257) Avail: AEC Depository Libraries

A theoretical estimate of the strength and deformation dependence of the two-body interaction producing the nuclear field is discussed and tested by a RPA calculation. The conclusion is that the obtained two-body interaction may be used to describe the nuclear collective phenomena Author (NSA)

N71-38389/ United Kingdom Atomic Energy Authority, Harwell (England).
USE OF DIAMOND AS A REFERENCE STANDARD FOR

IRRADIATION CONDITIONS
V. A. Nikolaenko et al Oct. 1969 17 p refs Transl. into ENGLISH from Russian report IAE-1650 Presented at the Joint UK/USSR Seminar on the Operation and Use of Res. and Testing Reactors, Harwell, England, Oct. - Nov. 1969
(LB/G-3027; Conf-691060-15) Avail: AEC Depository Libraries

Arguments are presented concerning the choice of a suitable standard for recording and retaining information on the irradiation conditions for materials investigations in a nuclear reactor. It is shown that diamond is one of the best materials for this purpose. A method is described for using diamond to measure the neutron flux causing radiation damage in materials. Methods are also described for measuring the irradiation temperature using calibrated and preirradiated diamond. Experimental results are presented which show that diamond can be used simultaneously to indicate neutron flux and irradiation temperature and to record the level of gamma-radiation in the reactor. Author (NSA)

N71-38400# Los Alamos Scientific Lab., N.Mex.
FISSION AND CAPTURE CROSS SECTIONS OF SOME CURIUM ISOTOPES FROM THE PHYSICS 8 NUCLEAR EXPLOSION
R. D. Bayberz, F. B. Simpson, M. E. Ennis, G. A. Keyworth, M. S. Moore et al Dec. 1970 173 p refs
(Contract W-7405-eng-36)
(LA-4566) Avail: NTIS

Using the nuclear explosion Physics 8 as a neutron source, the fission cross sections of Cm-244, Cm-245, Cm-246, and Cm-247, and Cm-248 were measured between 20 eV and 3 MeV. The radiative capture cross section of Cm-244 was determined between 20 eV and 10 keV, and the radiative capture of Cm-246 and Cm-248 was determined for several resonances in these isotopes. Tabulations of the data obtained are appended. Author (NSA)

N71-38401# American Micromation Industries, Inc., Philadelphia, Pa.
NEW 0(PLUS) STATES IN Te-124 AND Te-126
Zh. T. Zhelev et al May 1971 8 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Ser. Fiz. (Moscow), v. 35, no. 1, 1971 p 43-47 Sponsored by AEC Prepared for ANL
(ANL-Trans-883) Avail: NTIS

Beta and electron capture decay of I-124 and I-126 were studied by measuring the gamma and conversion-electron spectra by coincidence techniques. Spin-parity assignments and multipolarities were determined for Te-124 and Te-126. Several new energy levels were discovered. NSA

N71-38402# Iowa State Univ. of Science and Technology, Ames.
PHOTONEUTRON CROSS SECTION IN THE GIANT RESONANCE REGION FOR SEVERAL 82 NEUTRON ISOTONES
Ronald G. Johnson (Ph.D. Thesis) Feb. 1971 134 p refs
(Contract W-7405-eng-82)
(IS-T-418) Avail: NTIS

Cross sections for the reactions Ba-138(gamma,n) Ba-137m, Ce-140(gamma,n) Ce-139m, and Nd-142(gamma,n) Nd-141m were measured from threshold to near 25 MeV. Cross sections were extracted from bremsstrahlung-induced yield curves of the metastable state residual radioactivity by using least structure analysis. Peak energy and giant resonance width as well as peak and integrated cross sections are given for each nucleus. Structure in the cross section is observed in each case that is similar to that seen in the Pr-141(gamma,n) Pr-140 cross section. The narrow resonances observed in these cross sections appear to have widths of 100 to 300 keV and an average spacing of approximately 800 keV. Possible correlation of the structure in the cross sections for the four 82-neutron isotones is discussed. Author (NSA)

N71-38403# Princeton Univ., N.J. Dept. of Physics.
NEUTRAL DECAYS OF THE ETA(0), OMEGA(0), AND X(0) MESONS
Michael N. Kreisler 1971 20 p refs Presented at Intern. Conf. on Meson Resonances and Related Electromagnetic Phenomena, Bologna, 14-16 Mar. 1971 Sponsored by AEC
(PURC-4159-29) Avail: NTIS

The results of a series of experiments that were performed to study the neutral decays of the eta and omega mesons are described. Meson production was identified by measuring the momentum and angle of the neutrons using large liquid scintillation counters. The mesons were produced in the reaction pion(-) proton yields neutron + eta meson, omega meson, or X(0) meson. Single gammas from the neutral decays of the mesons were then momentum-analyzed in a spark-chamber-magnet spectrometer and transformed to the center of mass of the meson. After background subtraction, the momentum spectrum allows for identification of the various decay modes as well as calculation of the branching ratios. Author (NSA)

N71-38404# Argonne National Lab., Ill.
PHYSICS DIVISION ANNUAL REVIEW Summary Report, 1 Apr. 1969 - 31 Mar. 1970
31 Mar. 1970 213 p refs
(Contract W-31-109-eng-38)
(ANL-7728) Avail: NTIS

An overall view is presented of the research being conducted by the physics division at the Argonne National Laboratory in the following areas: experimental nuclear physics, theoretical physics, and experimental atomic physics. Papers published in the period April 1, 1969 to March 31, 1970 are listed. NSA

N71-38405# Kanner (Leo) Associates, Redwood City, Calif.
RELATIVISTIC SOLITONS AND NONLINEAR WAVES AS BUNCHES FOR COHERENT ACCELERATION
V. N. Tsytovich Feb. 1971 14 p refs Transl. into ENGLISH from Russian report JINR-P9-5090 Prepared for Calif. Univ., Berkeley, Lawrence Radiation Lab. Sponsored by AEC
(UCRL-Trans-1442; JINR-P9-5090) Avail: NTIS

The structure of nonlinear waves and solitons with phase velocities near to the light velocity was considered. Expressions for the maximum potential difference and maximum electric field strength are given. The problems of excitation of these waves with the help of relativistic electron beams and relativistic electron rings were discussed. The maximum electric field strength in solitons that are propagating across the magnetic field can be of the order of the external magnetic field strength. Author (NSA)

N71-38406# Oak Ridge National Lab., Tenn.
PHOTOELECTRIC DETERMINATION OF ELECTRON ATTENUATION LENGTHS IN MAGNESIUM AND ALUMINUM
T. F. Gesell (Ph.D. Thesis - Tenn. Univ., Knoxville) and E. T. Arakawa Jun. 1971 178 p refs
(Contract W-7405-eng-26)
(ORNL-TM-2617) Avail: NTIS

A model for volume photoemission is given which relates photoelectron energy distributions and yields to a number of parameters. The parameters are the thickness, optical constants, and densities of states of the photoemitter, the optical constants of the substrate, the wavelengths, polarization and angle of incidence of the exciting radiation, and an energy dependent electron attenuation length. Two methods for obtaining the electron attenuation length are included. Near normal incidence reflectance measurements on magnesium are given together with an interpretation based upon the Drude model and surface plasmon excitation. Absolute photoelectric yield measurements on magnesium are shown as a function of photon energy. Experimental electron attenuation lengths, were obtained for magnesium in the 5.11 eV range and for aluminum in the 11.19 eV range by analyzing reflectance, yield, and energy distribution data. In addition, measurements of the relative photoelectric

yield of aluminum as a function of angle are analyzed to obtain the attenuation length for all electrons photoemitted by 21.2 eV photons. Author

N71-38407# Atomic Energy Commission Research Establishment, Lucas Heights (Australia).
PEARLS: A CODE FOR THE SOLUTION OF THE NEUTRON SLOWING DOWN EQUATIONS IN MULTIREGION LATTICES OF RESONANCE ABSORBERS
C. Chierella Feb. 1971 25 p
(AAEC/E-213) Avail: AEC Depository Libraries

The code PEARLS calculates the resonance escape probability by numerically solving the neutron slowing down equations. The code uses collision probability methods for the spatial aspects of the multiregion problem (up to 4 regions) and uses resonance data covering the range 20 keV to 0.07 eV with 124,000 energy points. The program is written in FORTRAN for the IBM 360/50H computer. Most calculations are carried out in double precision (64 bits) although the main bulk of information is stored in single precision (32 bits). Author (NSA)

N71-38408# Australian National Univ., Canberra. Dept. of Nuclear Physics.
[NUCLEAR PHYSICS RESEARCH] Annual Report, 1970
Jan. 1971 38 p refs
(ANU-P-513) Avail: AEC Depository Libraries

Research programs in reaction mechanism studies are discussed. Subjects presented are: (1) nuclear astrophysics, (2)heavy ion induced reactions, (3) isobaric analog states, (4) radiative proton capture reactions, (5) beam foil and general nuclear spectroscopy, and implantation of excited ions into magnetic solids. Research equipment, staff, and staff publications are listed. Author (NSA)

N71-38409# Institute of Nuclear Research, Warsaw (Poland).
THE DECAY SCHEME OF Pa-232
R. Kaczarowski, W. Kurcewicz, A. Plochocki, and J. Zylicz 1970 31 p refs
(INR-P-1232) Avail: AEC Depository Libraries

Magnetic and semiconductor (Ge and Si) spectrometers were used to study the Pa-232 yields U-232 decay scheme. The following gamma lines were observed: 922.7, 1003.3, 1016.4, 1055.4, 1085.4, 1125.1, 1132.7, and 1164.5 keV. Conversion coefficients and multipolarity assignments were determined for several of these transitions. Due to the electron-gamma coincidence studies, it was possible to show that the 1125.1 and 1055.4 keV E1 transitions feed respectively the 2(+) and 4(+) levels of the U-232 ground state band. This indicates the existence of U-232 levels at 1172.8 and 1212.1 keV which are interpreted as 2(-) and 3(-) members of the K sup pi = 1(-) octupole band. Another level is proposed at 1132.9 keV. As deduced from the beta-gamma coincidence experiments, the beta(-) decay energy of Pa-232 is equal to 1337 + or - 10 keV. The experimental data in terms of nuclear models is concentrated on the octupole bands and their Coriolis interaction. Author (NSA)

N71-38410# Japan Atomic Energy Research Inst., Tokyo.
STUDY OF NUCLEAR PHYSICS WITH LINAC
Naomoto Shikazono and Nakajima Naomoto, eds. Mar. 1971 119 p refs In JAPANESE; ENGLISH summary Conf. held at Tokyo, 19-21 Feb. 1970
(JAERI-1208; Conf-700223) Avail: AEC Depository Libraries

Abstracts are presented of papers prepared for the conference on electron linear accelerator applications in nuclear physics and research. Topics covered included: photonuclear reactions; excited states in He-4; pygmy resonance; isotopic spin mixing in giant dipole resonance; low-lying states in Be-9; nuclear photoeffect; alpha decay from some excited states of C-12 above the proton threshold; structure of first excited 0(+) state of O-16; inelastic electron scattering from light nuclei; structure of Li-6 with electron scattering; particle reactions associated with photonuclear reactions on light nuclei; electromagnetic form factor of Ne-20; E1 IAS in medium weight nuclei; improvements in electron scattering by nuclei; review of photonuclear reactions; photonuclear fission near the nuclear fission threshold; alpha-like spatial four-body correlations and electron scattering; significance of nuclear photoreaction among studies in the continuum region; and photonuclear reaction and doorway state. A.L.

N71-38411# Case Western Reserve Univ., Cleveland, Ohio.
SEARCH FOR THE DOUBLE BETA DECAY OF Nd-150 USING A MAGNETIC SPECTROMETER-DETECTOR
Gary R. Smith 1970 68 p refs Sponsored by AEC
(COO-1749-23) Avail: NTIS

A large aperture, low resolution magnetic spectrometer-detector was designed and constructed to search for the double beta decay of Nd-150. The spectrometer-detector was operated for approximately 750 hours in the low background environment of a salt mine, 2000 feet below ground level. Lower limits were set on the two neutrino and no neutrino decay modes. An interpretation of the results in terms of the character of the electron neutrino and lepton conservation is made. Author (NSA)

N71-38412# New York Univ., N.Y. Dept. of Chemistry.
AN INTERPRETATION OF PHOTOELECTRON EMISSION SPECTROSCOPY
Paul Delahay Jun. 1971 38 p refs
(Contract N00014-67-A-0467-0019)
(AD-727096; TR-16) Avail: NTIS CSCL 07/4

The process of photoelectron emission (PEE) by solutions is decomposed into two steps: generation of electrons in unbound states in solution by irradiation; escape of unbound electrons into the gas above the solution. The transition rate for the first step is expressed in terms of the photon energy and the energy for transition to the continuum. The complete absorption band for bound-unbound transitions in solution is calculated. Experimental PEE currents for different emitters (solvated electrons in liquid ammonia or hexamethyl phosphoric triamide, ferrocyanide in water) vary linearly with photon energy after normalization to a constant transition rate. This result is interpreted by assuming that unbound electrons undergo a random walk in solution and lose their kinetic energy at a rate inversely proportional to their speed. The Schottky effect on PEE is also interpreted. Author (GRA)

N71-38413# New York Univ., N.Y. Dept. of Chemistry.
PHOTOELECTRON EMISSION SPECTROSCOPY OF SOLVATED ELECTRONS
Bill Baron, Paul Delahay, and Roberto Lugo Jun. 1971 31 p refs
(Contract N00014-67-A-0467-0019)
(AD-727099; TR-14) Avail: NTIS CSCL 07/4

Instrumentation and methodology were developed for photoelectron emission (PEE) spectroscopy of sodium solutions in hexamethyl phosphoric triamide (HMPA) for irradiation from 1 to 3.7 eV. PEE currents were corrected by the Thomson equation for back scattering in the gas (nitrogen at 200 to 800 torr) above the solution. The Schottky effect for PEE was smaller than for thermionic emission and decreased with increasing photon energy. PEE spectra exhibited two steps corresponding, respectively, to emission by solvated electron species and metal species. The corresponding thresholds, obtained from Einstein plots, are approximately 1.4 and 2.6 eV. The first threshold is compared with the energy of the 1s state for a simple cavity model. Quantum yields were low, e.g., 0.00001 emitted electron per incident photon. Thermionic and PEE currents are correlated. Author (GRA)

N71-38414# Arcon Corp., Wakefield, Mass.
A NEW FALLOUT TRANSPORT CODE FOR THE DELFIC SYSTEM: THE DIFFUSIVE TRANSPORT MODULE Final Report

Hillyer G. Norment and Elihu J. Tichovolsky 1 Mar. 1971 258 p refs
(Contract DASA01-70-C-0104)
(AD-727813; R-71-1W; DASA-2689) Avail: NTIS CSCL 18/8

A new fallout transport model and code has been developed for the Defense Land Fallout Interpretative Code (DELFIC). This model stresses the combined effects on transport of vertical turbulent diffusion and particle settling. The model transports fallout either via the conventional advection plus settling mode. The mode choice, which is made independently for each fallout parcel by the program, is based on atmospheric conditions and parcel properties. Alternatively, transport can be done exclusively by advection plus settling. In any case, turbulent dispersion in the horizontal is accounted for. This code replaces the DELFIC Transport Module that is described in DASA-1800-IV.
Author (GRA)

N71-38415# Boston Coll., Chestnut Hill, Mass. Dept. of Chemistry.
A DISTORTED WAVE BORN THEORY FOR THE COLLISIONAL DISSOCIATION OF MORSE OSCILLATORS
Jeong-Long Lin Aug. 1971 23 p refs
(Contract N00014-69-A-0453)
(AD-727576; FRK-115) Avail: NTIS CSCL 07/4

A quantum mechanical theory for the vibrational dissociation of diatomic molecules to neutral atoms due to a direct excitation in a strong collision is presented. The diatomic molecules are considered as Morse oscillators and the distorted-wave Born approximation is used. The theory is then applied to study the dissociative probability in the system X+Y sub 2, where X = He, Ar and Y sub 2 = H2, D2. The result indicates that unless the temperature is high (approximately 5000 K), dissociation by a direct excitation mechanism is small. Author

N71-38416# Rochester Univ., N.Y. Nuclear Structure Research Lab.
EXPERIMENTAL EVIDENCE FOR SHAPE TRANSITIONS IN NUCLEI
D. Cline Aug. 1971 59 p refs Presented at Colloq. on Intermediate Nuclei, Orsay, France, 30 Jun. 1971 Submitted for publication Sponsored by NSF
(UR-NSRL-40) Avail: NTIS

It is demonstrated that the quadrupole collective properties of the low-lying spectrum of even mass nuclei can all be correlated to a deformation parameter and an asymmetry parameter. This correlation between the level spectrum and E2 properties occur for nuclei throughout the transition region from spherical to and including the deformed region and throughout the periodic table. The static electric quadrupole moments give a sensitive measure of the asymmetry parameter for a nuclear level, and the E2 sum rule technique provides a model independent determination of the collective properties of individual nuclear levels. Author

N71-38417# Northeastern Univ., Boston, Mass. Dept. of Physics.
SCALE INVARIANCE AND SCALE BREAKING
M. H. Friedman, P. Nath, and R. Arnowitt Aug. 1971 10 p refs Supported in part by NSF
(NUB-2097) Avail: NTIS

A field-current identity formalism for the stress tensor is set up. The Poincare group constraints are imposed and seen to determine the form of the f-meson couplings to arbitrary order. A scale breaking condition is introduced in terms of a universality principle of meson couplings to the stress tensor. Author

N71-38418# Northeastern Univ., Boston, Mass. Dept. of Physics.
APPLICATIONS OF BROKEN SCALE INVARIANCE
R. Arnowitt, M. H. Friedman, and P. Nath Aug. 1971 10 p refs Supported in part by NSF
(NUB-2098) Avail: NTIS

The principles of broken scale invariance are applied to a number of theoretical and experimental situations. The universality relations are satisfied. The scale breaking condition modifies the form of the vector current so that it has canonical scale dimension three, and leads to annihilation cross sections E+ + E- yields 4 pions of approximately equal to 10 to the -32nd power sq cm. Author

N71-38419# National Bureau of Standards, Washington, D.C. Nuclear Radiation Div.
COMPUTER CODE FOR THE CALCULATION OF THERMAL NEUTRON ABSORPTION IN SPHERICAL AND CYLINDRICAL NEUTRON SOURCES
V. Spiegel, Jr. and W. M. Murphey May 1971 40 p refs
(NBS-TN-576) Avail: SOD $0.35

A computer code was written in FORTRAN 4 for the calculation of thermal neutron absorption in spherical and cylindrical neutron sources. The formalism of the calculation, the structure of the computer code, a listing of the code, and some sample results are presented. Author

N71-38420# Case Western Reserve Univ., Cleveland, Ohio. Div. of Electrical Sciences and Applied Physics.
ELECTRON-MAGNON INTERACTION IN THE ITINERANT ELECTRON FERROMAGNET
Isoris Gergis Sep. 1971 129 p refs
(TR-71-2) Avail: NTIS

The effect of electron-magnon interaction in the itinerant electron ferromagnet on the energy and life time of magnons is determined. The energy of the magnon is obtained by solving for the low energy poles of the dynamic spin susceptibility. The susceptibility is determined by evaluating first the corresponding temperature dependent Matsubara Green's function and obtaining the susceptibility by analytic continuation in the complex frequency plane. The Matsubara function is determined using the diagram summation technique. Author

N71-38421# Illinois Univ., Urbana. Dept. of Physics.
A CLUSTER DECOMPOSITION APPROACH TO THE PHENOMENOLOGY OF INCLUSIVE AND EXCLUSIVE PROCESSES AT HIGH ENERGY
D. K. Campbell and S.-J. Chang 1971 11 p refs
(Grant NSF GP-25303)
(ILL-(TH)-71-11) Avail: NTIS

A cluster decomposition approach to the description of high energy multiparticle production processes is formulated in a model-independent way. The utility of this technique for phenomenology is discussed and the manner in which it provides a profound simplification of the analysis of complicated multi-particle events is emphasized. It is shown that the cluster decomposition provides a natural framework in which to relate the correlations among the final state particles in exclusive processes to those in inclusive processes. The relations so obtained can assume the form of sum rules constraining various inclusive cross sections and, under certain conditions, may prove very useful in analyzing high energy interactions. Author

N71-38422 National Lending Library for Science and Technology, Boston Spa (England).
A SILICON DETECTOR AS ABSOLUTE GAMMA DOSIMETER
C. Berg [1971] 11 p refs Transl. into ENGLISH from Nucl. Instr. Methods (Amsterdam), no. 92, 1971 p 21-27
(NLL-WHT-Trans-312-(9091.9F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The effects induced in materials by gamma radiation beams are measured using a silicon detector. Measurements were obtained from the energy dose or the energy dose rate. Such measurements can only be made at high dosage rates. Air is used as the measurement substance. Author

N71-38423 Georgia Inst. of Tech., Atlanta.
HYPERFINE STRUCTURE IN THE ROTATIONAL SPECTRUM OF ASYMMETRIC-TOP MOLECULES CONTAINING TWO IDENTICAL QUADRUPOLAR NUCLEI
William Arnall Little, Jr. (Ph.D. Thesis) 1970 106 p
Avail: Univ. Microfilms Order No. 70-19287

The diagonal matrix elements of the quadrupole Hamiltonian when applied to a molecule through first-order perturbation theory lead only to predicted patterns which are symmetric for the transitions under study. The derivation of off-diagonal matrix elements and their application through second-order perturbation theory lead to a theoretical explanation of the slightly asymmetric patterns under observation. The off-diagonal elements of the quadrupole Hamiltonian involve the off-diagonal element of the quadrupole coupling constant tensor. An accurate prediction of the asymmetric transition patterns leads to a determination of this physical parameter. The theory was applied to SCl2 and values for the diagonal elements of the coupling constant tensor were determined. A determination of the off-diagonal element was obtained. This resulted in close agreement between the angle described above and half the Cl-S-Cl bond angle.
Dissert. Abstr.

N71-38424 Tennessee Univ., Knoxville.
AN ANALYSIS SYSTEM FOR VIBRATION-ROTATION SPECTRA OF AXIALLY SYMMETRIC MOLECULES
Miguel Kurlat (Ph.D. Thesis) 1969 233 p
Avail: Univ. Microfilms Order No. 70-17831

A computer assisted assignment and analysis method for vibration-rotation spectra of axially symmetric molecules has been developed. The method has been tested by applying it to the nu sub 1, nu sub 2, nu sub 4, and nu sub 5 fundamentals of methyl bromide; results of the analysis are included. The approach taken has been to develop procedural algorithms suitable for translation into computer coding. This resulted in series of computer programs, which have been integrated into a software package. Listings of the programs are included. The system includes an algorithmic assignment program for complex spectra not amenable to standard assignment procedures. A new approach to analysis has been developed in which a general prediction modeling step is used to extend initial assignments. Finally, a rather complete linear regression and statistical analysis program has been developed for use in the determination of the molecular parameters, using the molecular Hamiltonian. Although the analysis of spectra exhibiting accidental resonances was not a goal in the development of the analysis system, it has been found that the prediction modeling step is extremely useful in the preliminary analysis of perturbed spectra, even in cases where standard approaches fail.
Dissert. Abstr.

N71-38425 Ohio State Univ., Columbus.
HIGH RESOLUTION ABSORPTION SPECTRA OF THE ISOTOPIC MODIFICATIONS OF NITROGEN DIOXIDE AND OTHER SMALL MOLECULES
Stephen Craig Hurlock (Ph.D. Thesis) 1970 158 p
Avail: Univ. Microfilms Order No. 70-19322

High resolution absorption spectra were recorded, measured and interpreted for five isotopic species representing the three different molecules, nitrogen dioxide, nitric acid vapor and deuterium iodide. New techniques were developed for the analysis of complex spectra and were applied to the spectra of nitrogen dioxide, an asymmetric rotor molecule. These techniques include the use of modern high speed computers to produce graphical plots containing large numbers of points. Certain patterns appear on these plots and are useful in rapidly sorting out and identifying sequences of associated spectral lines. The spectra studied include both electronic and vibration rotation spectra and are summarized according to the individual molecular species.
Dissert. Abstr.

N71-38426 Duke Univ., Durham, N.C.
SUBMILLIMETER WAVE ROTATIONAL SPECTRA OF AMMONIA AND PHOSPHINE
Paul Andrew Helminger (Ph.D. Thesis) 1969 133 p
Avail: Univ. Microfilms Order No. 70-18066

Rotational transitions of ammonia and phosphine in the vibrational ground state were observed with a standard video-sweep microwave spectrometer employing harmonic generation and having provision for phase sensitive detection. The J = 0 to 1 rotational transitions of (N-14)H3, (N-15)H3, (N-14)D3, and (N-15)D3 at 0.52 mm were measured, and the rotational constants were calculated to be 298,114.68, 297,359.32, 154,173.28, and 153,800.82 Mc/sec, respectively. The J = 1 to 2 rotational transitions of (P-31)H3 and (P-31)D3 at 0.56 mm were also measured. For PH3, the spectral constants obtained in Mc/sec are: rotational constant = 133,480.15, centrifugal stretching constant (D sub J) = 365, and D sub JK = -5.18; for PD3, the values are 69,471.09, 1.02, and -1.31, respectively.
Dissert. Abstr.

N71-38427 State Univ. of New York at Buffalo.
HYPERPOLARIZABILITIES FOR HARTREE-FOCK ATOMS
Richard E. Sitter, Jr. (Ph.D. Thesis) 1969 94 p
Avail: Univ. Microfilms Order No. 70-17366

An atom placed in a static external electric field reveals that charge distribution is distorted. If however, the field strength is increased, the charge distribution undergoes further distortion and the linear relation is no longer adequate as higher order terms contribute significantly to the hyperpolarizability. Calculations of the hyperpolarizability for the He, Be, Ne, and Ar atoms with the completely coupled Hartree-Fock approximation are presented. Of these, accurate calculations were obtained only for He. Study of the results of these calculations shows that the coupling of the Hartree-Fock equations has a profound effect and substantially reduces the errors involved.
Dissert. Abstr.

N71-38428 Pennsylvania State Univ., University Park.
PARTICLE-HOLE INTERACTIONS IN Zr-90
Wesley Rhodes (Ph.D. Thesis) 1969 96 p
Avail: Univ. Microfilms Order No. 70-18455

The energy levels of the (d5/2 nu)/(g9/2 nu) multiplet in Zr-90 are calculated with the nonlocal Tabakin interaction representing the bare nucleon interaction. Second Born terms are taken into account in the plane wave approximation, and, in addition, a microscopic approach is employed for the treatment of core polarization effects. Microscopic calculations are also carried out for states of the (d5/2 nu)(g9/2 pi) configuration in Nb-92. The resulting spectrum for the particle-hole states in Zr-90 agrees well with the experimental data except for the 2+ level which lies approximately 0.3 MeV too high. Excellent agreement is obtained for the six low-lying energy levels associated with the (d5/2 nu)(g9/2 pi) multiplet of Nb-92. Comparison of the isospin dependence of the two-body force for identical particles (T = 1) and nonidentical particles (T = 0,1) is presented.
Dissert. Abstr.

N71-38429 Tennessee Univ., Knoxville.
ELECTRON ATTACHMENT TO POLYATOMIC MOLECULES
Edward Larrette Chaney (Ph.D. Thesis) 1969 140 p
Avail: Univ. Microfilms Order No. 70-17808

Low-energy electron attachment to a number of polyatomic molecules has been investigated using a high-temperature electron swarm apparatus. Results are reported for nitrous oxide, azulene, biphenyl, aniline, acenaphthene, and 1,4-naphthoquinone. A simple model of electron attachment to polyatomic molecules is discussed and electron affinity calculations based on this model are presented for a number of molecules. Also, experimental data are presented and discussed which strongly support certain forms for the energy distribution functions for electron swarms in the carrier gases C2H4, N2, and Ar.
Dissert. Abstr.

N71-38625 Academy of Sciences (USSR), Moscow.
THE RADIOCARBON METHOD OF DETERMINING ABSOLUTE AGE
R. S. Zavelskiy *In its* Proc. of the 6th Ann. All-Union Winter

School on Space Phys., part 2 1969 p 158-163 refs In RUSSIAN (See N71-38582 24-30)
Avail: NTIS

N71-37988# Spetsialnaja Astrofizicheskaja Observatorija, St. Zhelenchukskaja (USSR).
THE SOVIET 6-m TELESCOPE PROJECT
I. M. Kopylov *In* European Southern Obs. Large Telescope Design Jun. 1971 p 85-98 (See N71-37960 24-14)
Avail: NTIS HC $6.00/MF $0.95

25 PHYSICS, PLASMA

Includes magnetohydrodynamics. For applications see: 28 Propulsion Systems.

N71-38430# Academy of Sciences (USSR), Moscow. Inst. of Atomic Energy.
MECHANISM OF PLASMA FOCUS FORMATION IN A COAXIAL INJECTOR
I. N. Burdonskii, R. P. Vasileva, M. I. Pergament, and A. I. Yaroslavsky 17 Jun. 1971 14 p refs In RUSSIAN; ENGLISH summary Presented at 4th Conf. on Plasma Phys. and Controlled Nucl. Fusion Res., Madison, Wis., 17 Jun. 1971
(CN-28/D-7; Conf-710607-42) Avail: AEC Depository Libraries

The mechanisms involved in the formation of a focus and the heating of the plasma therein are discussed. It is established that almost the entire current shorts through the fairly thin moving current layer only in the first, relatively short stage of the process. In the second stage, the current is at first distributed comparatively uniformly through the entire plasma volume; it then shorts at the rear end of the plasma gun, forming a current eddy. In the longitudinal sectional view of the electrode gap, the eddy-current lines look like nested ovals extending along the electrodes and projecting in the forward part beyond the electrode system. With time, the rear boundary of the current eddy shifts, together with the plasma, in the direction of acceleration, while the forward boundary of the current distribution remains stationary. The radial equilibrium of the current eddy depends on the fact that the forces j x H acting in that part of the current loop in which the current lines are almost parallel to the electrode system are balanced by the pressure gradient. The latter is due to the nonuniformity of Joule heating of the plasma in the current loop, as the current density is zero at the center of the electrode gap and rises sharply as the electrodes are approached. Author (NSA)

N71-38431# Academy of Sciences (USSR), Moscow. Inst. of Atomic Energy.
EXPERIMENTAL AND THEORETICAL INVESTIGATION OF A GAS DISCHARGE OF THE PLASMA FOCUS TYPE
V. I. Agafonov, I. F Belyaev, V. V Vikhrov, G. V. Golub, L. G. Golubchikov et al 17 Jun. 1971 34 p refs In RUSSIAN; ENGLISH summary Presented at 4th Conf. on Plasma Phys. and Controlled Nucl. Fusion Res., Madison, Wis., 17 Jun. 1971
(CN-28/D-6; Conf-710607-41) Avail: AEC Depository Libraries

The development of the high-current gas discharge accompanying the noncylindrical compression of the z pinch is discussed. In addition to the usual operating regimes, with uniform filling of the chamber with deuterium, variants involving a complex gas density profile are tried. Considerable attention is paid to the influence of impurities in the form of heavy atoms on the progress of the discharge. The principles underlying the increase in neutron yield as a function of capacitor bank energy and working gas composition are determined. Machine calculations were made of the motion of the plasma sheath when there are wide variations in the initial conditions and the electrotechnical characteristics of the discharge circuit. X-ray emission from a plasma focus was studied, and frame-by-frame photographs of the pinch through a thin aluminum filter with an exposure of about 30 ns were made. Author (NSA)

N71-38432# Ecole Royale Militaire, Brussels (Belgium). Lab. de Physique des Plasmas.
CYLINDRICAL PLASMA SOURCES WITH DENSITIES HIGH ABOVE CRITICAL DENSITY EXCITED BY AN RF HELIX WITH AND WITHOUT MAGNETIC FIELD
A. E. Aubert, A. M. Messiaen, and P. E. Vandenplas 17 Jun. 1971 16 p refs Presented at the 4th Conf. on Plasma Phys. and Controlled Nucl. Fusion Res., Madison, Wis., 17-23 Jun. 1971
(CN-28/L-3; Conf-710607-139) Avail: AEC Depository Libraries

It is shown that the density characteristics of plasmas created by an RF helix are essentially determined by the low power resonance features of the bounded system, which is constituted by the plasma column and the surrounding helix of finite axial length. The RF power absorbed by the system is calculated, using the theoretical model of a cold electron-ion collisional plasma. Whether a magnetic field is present or not, plasma densities high above critical density are obtained, in agreement with the general philosophy previously developed. For each azimuthal n-mode present, the appropriate boundary conditions select discrete values of k on the dispersion curve of the infinite plasma. Experiments already performed support the theoretical predictions. When no steady magnetic field is present, very detailed comparison with experiments was performed and shows good agreement. Author (NSA)

N71-38433# Institut fur Plasmaphysik G.m.b.H., Garching (West Germany).
TOROIDAL SCREW PINCH WITH NONCIRCULAR PLASMA CROSS SECTION
R. Wilhelm and H. Zwicker 17 Jun. 1971 7 p refs Presented at the 4th Conf. on Plasma Phys. and Controlled Nucl. Fusion Res., Madison, Wis., 17-23 Jun. 1971
(CN-28/B-7; Conf-710607-18) Avail: AEC Depository Libraries

Application of MHD theory to a screw pinch or Tokamak with circular cross section shows that equilibrium and stability are obtainable only at Beta values of the order of several percent. Simple equilibrium and stability considerations for a screw pinch with flat plasma cross section, however, showed that, in this case, Beta values in the region Beta nearly equal to 1 should be allowed. Using the low-inductive capacitor bank ISAR IV in a toroidal discharge chamber with a volume of 220 liters in a flat geometry (50 cm mean diameter, 100 cm height), the plasma is produced by a fast-rising magnetic field. Results concerning equilibrium and stability of this flat plasma in the temperature regime of 100 to 500 eV are reported.
Author (NSA)

N71-38434# Institut fur Plasmaphysik G.m.b.H., Garching (West Germany).
EXPERIMENTS ON A TOROIDAL SCREW PINCH WITH VARIOUS FIELD PROGRAMMING
H. Zwicker, R. Wilhelm, and H. Krause 17 Jun. 1971 12 p refs Presented at the 4th Conf. on Plasma Phys. and Controlled Nucl. Fusion Res., Madison, Wis., 17-23 Jun. 1971
(CN-28/B-6; Conf-710607-17) Avail: AEC Depository Libraries

In the toroidal screw pinch ISAR IV (large diameter 60 cm, aspect ratio 5, max. storage energy 140 kJ) attempts were made to get an improved stability of the plasma by different kinds of field programming. The best results were obtained with positive trapped B sub z fields and simultaneous switching of main B sub z field and I sub z current. In this case the dense plasma column is surrounded by a force free plasma with weak shear and it behaves stably for at least 25 micro seconds. The resulting containment time of near 10 to the 12th power s per cubic centimeter remains a factor of 2 to 3 below the upper limit given by the classical diffusion. The following loss of the equilibrium position near the coil axis is connected to a strong damping of the axial plasma current, which starts near the end of the containment. It may be assumed that the increase of the effective plasma resistance mainly results from a contact of the force-free regions to the tube wall. Attempts were made to improve the containment by suitable programming of a plasma z-current. Author (NSA)

N71-38435# United Kingdom Atomic Energy Authority, Culham (England).
EXPERIMENTAL AND THEORETICAL STUDIES OF A HIGH-BETA TOROIDAL PINCH
H. A. B. Bodin, E. P. Butt, J. E. Crow, F. E. Irons, J. Junker et al 17 Jun. 1971 23 p refs Presented at the 4th Conf. on Plasma Phys. and Controlled Nucl. Fusion Res., Madison, Wis., 17-23 Jun. 1971
(CN-28/B-5; Conf-710607-16) Avail: AEC Depository Libraries

Longitudinal currents and fields up to 250 kA and 12 kG were used, with risetimes about 10 microsec. The quartz torus, major diameter 2 m and bore 12 cm, was filled with deuterium between 10 and 50 mtorr pressure. Theoretically, unless the pressure gradient is positive, a pitch minimum is sufficient for instability. Stability is possible with total beta up to 0.3 to 0.4 when the external current and field reverses. The inclusion of compressibility increases instability growth rates, and three characteristic eigenfunctions are computed, two of which are identified in the experiment. Estimates show energy losses that can be neglected for power inputs of approximately or > 25 eV/particle/micro sec, obtainable by compression, can become important at power inputs typical of resistive heating. In screw pinches, temperatures up to 200 eV are obtained in the central core. Author (NSA)

N71-38436# Stichting voor Fundamenteel Onderzoek der Materie, Jutphaas (Netherlands). Inst. voor Plasma-Fysica.
DECAY OF THE LONGITUDINAL CURRENT IN TOROIDAL SCREW PINCHES
P. C. T. van der Laan, W. Schuurman, J. W. A. Zwart, and J. P. Goedbloed 17 Jun. 1971 6 p refs Presented at the 4th Conf. on Plasma Phys. and Controlled Nucl. Fusion Res., Madison, Wis.
(CN-28/B-4; Conf-710607-15) Avail: AEC Depository Libraries

In toroidal screw-pinch experiments in Garching and in Jutphaas, the longitudinal plasma current is observed to decay rapidly, leading to a loss of equilibrium or to instability. A number of causes for this decay are listed. The problem of the matching of a decaying pinch to the external circuits is discussed. External losses in the z-circuit give rise to currents in the plasma near the wall and, thereby, to an enhanced decay of the net longitudinal plasma current. Losses in the Theta-circuit, however, tend to increase the longitudinal current. Also, the volume currents flowing in a combined pinch lead to a transfer of energy from one field component to the other; calculations are given for a uniform-pitch screw pinch. A toroidal screw pinch oscillates around its eccentric equilibrium position. The oscillation may force field lines into the wall and thereby decrease the plasma current. This effect diminishes when the external inductances in the z-circuit are small. Author (NSA)

N71-38437# United Kingdom Atomic Energy Authority, Culham (England).
EXPERIMENTAL STUDY OF DRIFT WAVE STABILIZATION
B. E. Keen and P. E. Stott 17 Jun. 1971 11 p refs Presented 4th Conf. on Plasma Phys. and Controlled Nucl. Fusion Res., Madison, Wis.
(CN-28/B-13; Conf-710607-23) Avail: AEC Depository Libraries

The dc shear stabilization was studied in a 4-meter-long column of thermally ionized alkali metal plasma. At densities of 10 to the 8th power to 10 to the 9th power/cu cm, the plasma is collisionless. A strongly sheared magnetic field is produced by means of a helical winding surrounding the plasma. As the shear is increased from zero, the amplitude of the unstable drift waves is reduced. Successful experiments were performed on the feedback stabilization of collisional drift waves in various gaseous ore plasmas. The results were interpreted in terms of nonlinear theory of the Van der Pol type which predicts a variation of the instability amplitude and its frequency as a function of the gain and phase angle in the feedback loop. Dynamic stabilization of collisional drift instabilities was demonstrated in helium and hydrogen after-glow plasmas, in which an oscillating azimuth magnetic field is applied to the plasma, perpendicular to the main confining field. The mechanism for stabilization is that the azimuthal field provides a path for electrons to cross the dc field lines, thus short-circuiting the instability. Dissert. Abstr.

N71-38438# Scientific Research Inst. of Electro-Physical Apparatus, Leningrad (USSR).
HIGH FREQUENCY STABILIZATION OF A CURRENT CARRYING TOROIDAL PLASMA COLUMN IN A LONGITUDINAL MAGNETIC FIELD
M. A. Vasilevskii, I. M. Rolfe, and E. V. Seredenko, 17 Jun. 1971 16 p refs In RUSSIAN Presented at the 4th Conf. on Plasma Phys. and Controlled Nucl. Fusion Res., Madison, Wis.
(CN-28/B-12; Conf-710607-22) Avail: AEC Depository Libraries

The Tolcsokop device was used to study a stabilized current-carrying toroidal plasma column in a longitudinal magnetic field for a stability margin coefficient q less than or equal to 1. The boundaries of the stability regions determined in the experiment for various quasi-constant and high-frequency (stabilizing) current ratios are compared with estimates based on the model of a plasma column with a boundary in the region of the high-frequency-current skin effect. Author (NSA)

N71-38439# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Sukumi (USSR).
PENETRATION OF THE ION-ACOUSTIC BARRIER WHEN AN ALTERNATING CURRENT FLOWS IN A TOROIDAL MAGNETIZED PLASMA
R. A. Demirkhanov, A. G. Kirov, V. N. Zharikov, V. A. Zhadov, and N. I. Malykh 17 Jun. 1971 23 p refs In RUSSIAN, ENGLISH summary Presented at 4th Conf. on Plasma Phys. and Controlled Nucl. Fusion Res., Madison, Wis., 17 Jun. 1971
(CN-28/B-10; Conf-710607-21) Avail: AEC Depository Libraries

Investigation of the phenomena accompanying the flow of an alternating current subject to the skin effect in a magnetized toroidal plasma (when the drift velocity of the electrons can exceed the ion sound velocity) is of interest when considering the possibility of using hf fields in the megahertz range for the dynamic stabilization of plasmas. The phenomena accompanying the flow of an alternating current in a magnetized toroidal plasma pinch in the R-Om device are described. Two cases are investigated: (1) a relatively weak hf current in a quasi-continuous regime; and (2) a short hf current pulse with a constant damping time. Author (NSA)

N71-38440# Institut fur Plasmaphysik G.m.b.H., Garching (West Germany).
DYNAMIC STABILIZATION OF THE M EQUALS 1 MODE ON A SCREW PINCH
G. Becker, O. Gruber, and H. Herold 17 Jun. 1971 13 p refs Presented at the 4th Conf. on Plasma Phys. and Controlled Nucl. Fusion Res., Madison, Wis., 17-23 Jun. 1971
(CN-28/B-9; Conf-710607-20) Avail: AEC Depository Libraries

Dynamic stabilization of the helical m = 1 instability characteristics for the high beta screw pinch was studied in the linear device leer 3 (T sub i = 50 to 200 eV; beta approximately 0.5). The growth rates omega sub i and wavelengths of these modes were found to be very similar in the toroidal and linear leer screw pinches for adequate plasma parameters. Mainly, two methods of dynamic stabilization were investigated: superimposing an axially uniform hf B sub z field B sub z on the quasisteady B sub zo; and superimposing an hg axial current I sub z on the screw pinch. Preliminary experiments were performed with the magnetic field configuration of a standing wave. The stabilizing effect of the axially uniform B sub z is very likely caused by inertial forces in the oscillating plasma column. The experimentally determined C values were about 1.5 to 2.5. It is further demonstrated that the fulfillment of this condition is facilitated when working in resonance with the natural plasma oscillation. Author (NSA)

N71-38441# Commissariat a l'Energie Atomique, Fontenay-Aux-Roses (France). Centre d'Etudes Nucleaires.
STATISTICAL STUDY OF A HELIUM PLASMA OUTSIDE LOCAL THERMODYNAMIC EQUILIBRIUM [ETUDE STATISTIQUE D'UN PLASMA D'HELIUM HORS D'EQUILIBRE THERMODYNAMIQUE LOCAL]
Francoise Emard (Ph.D. Thesis - Paris Univ.) Jan. 1971 142 p refs In FRENCH
(EUR-CEA-FC-578) Avail: AEC Depository Libraries

Nonlocal thermodynamic equilibrium plasmas can be described on the basis of a statistical model of elementary processes. This model is developed for a helium plasma in which the structure of the helium atom is accounted for. The electronic, atomic, and radiative processes that are susceptible to modify the composition of the plasma is given. The rate coefficients are established on the basis of these reaction processes, which permit the calculation of the population densities of all levels, the degree of ionization, and the collisional-radiative recombination and ionization coefficients. Assuming a Maxwellian velocity distribution, analytical expressions for the rate coefficients could be established. The population densities were expressed as a function of two dimensionless coefficients and of the particle density in the ground state. The numerical values of the dimensionless coefficients are presented graphically as a function of the principal quantum number for different cases of radiative absorption, electron density, and temperature. Author (NSA)

N71-38442# Institut fur Plasmaphysik G.m.b.H., Garching (West Germany).
EXPERIMENTAL STUDY OF COLLECTIVE DISSIPATION IN SHOCK WAVES FOR A WIDE RANGE OF PLASMA PARAMETERS
M. Keilhacker, M. Kornherr, H. Niedermeyer, K.-H. Steuer, and R. Chodura 17 Jun. 1971 16 p refs Presented at the 4th Conf. on Plasma Phys. and Controlled Nucl. Fusion Res., Madison, Wis., 17-23 Jun. 1971
(CN-28/J-10; Conf-710807-122) Avail: AEC Depository Libraries

Collective dissipation in collisionless shock waves was investigated in two theta-pinch experiments. These investigations are complementary in that the plasma parameters governing the onset of certain instabilities leading to microturbulence and collective dissipation can be varied over a wide range. In the 'Turbulent Heating Experiment' (coil diameter 16 cm) the shock waves propagate into an initial deuterium plasma produced by a fast theta pinch. Quasi-stationary shock waves can be generated for Mach numbers M ranging from 1.5 to 5. Time-resolved light-scattering measurements (ruby and pulsed CO2 lasers) show strong collisionless electron heating accompanied by density fluctuations that are up to 250 times the thermal value. The frequency and wave number spectra as well as the angular distribution of this turbulence are measured. Author (NSA)

N71-38443# Akademiya Nauk URSR, Kiev. Fiziko-Tekhnicheskii Inst.
EXPERIMENTAL RESEARCH ON NONLINEAR EFFECTS IN THE INTERACTION OF NONRELATIVISTIC AND RELATIVISTIC BEAMS WITH A PLASMA
A. S. Bakai, A. K. Berezin, G. P. Berezina, L. I. Bolotin, A. M. Egorov et al 17 Jun. 1971 39 p refs In RUSSIAN Presented at the 4th Conf. on Plasma Phys. and Controlled Nucl. Fusion Res., Madison, Wis., 17-23 Jun. 1971
(CN-28/E-9; Conf-710807-57) Avail: AEC Depository Libraries

An experimental investigation was carried out of the nonlinear processes of interaction of waves with particles and of waves in plasma-beam discharges: the threshold excitation of low-frequency waves by high-frequency waves and the induced scattering of waves on the plasma electrons were established; the mechanism of plasma electron and ion heating in low-frequency and high-frequency fields was studied; also, the influence of the effect exerted by the transformation of high-frequency waves on the stabilization of low-frequency instability was investigated. It is shown that, under the given conditions, the coefficient for the transformation of high-frequency into low-frequency oscillations is anomalously high. Methods were developed for the control of low-frequency instabilities. The role was determined of various types of low-frequency oscillations in the heating of the plasma. Experimental confirmation was obtained of the theoretically predicted effect of nonlinear Landau damping in a strong magnetic field (including scattering). Author (NSA)

N71-38444# Centre de Recherches en Physique des Plasmas, Lausanne (Switzerland).
ANOMALOUS RESISTIVITY IN AN RF CONFINED PLASMA: THEORY AND EXPERIMENT
F. Hofmann 17 Jun. 1971 16 p refs Presented at the 4th Conf. on Plasma Phys. and Controlled Nucl. Fusion Res., Madison, Wis., 17-23 Jun. 1971
(CN-28/B-8; Conf-710807-19) Avail: AEC Depository Libraries

MHD calculations are compared with measurements made on an RF-confined, high-beta plasma. It is shown that the electrical resistivity in the current-carrying skin layer considerably exceeds the classical value. Several theoretical formulae for anomalous resistivity, multiplied by arbitrary scaling factors, are used in the calculations. Optimum values for the scaling factors are found by comparison with measurements. Author (NSA)

N71-38445# Comitato Nazionale per l'Energia Nucleare, Frascati (Italy). Lab. Gas Ionizzati.
STRUCTURE OF THE DENSE PLASMA FOCUS. PART 1: NUMERICAL CALCULATIONS, X-RAY, AND OPTICAL MEASUREMENTS
P. Gratteau, G. Luzzi, Ch. Maisonnier, F. Pecorella, J. P. Rager et al 17 Jun. 1971 11 p refs Presented at the 4th Conf. on Plasma Phys. and Controlled Nucl. Fusion Res., Madison, Wis., 17-23 Jun. 1971
(CN-28/D-1; Conf-710807-38) Avail: AEC Depository Libraries

The numerical calculations are based upon the application of Potter's code to a particular DPF geometry. The implosion phase, the radial oscillations of the plasma, and the axial drift of constant density profiles in the plasma column are studied. The electron temperature is determined by detecting simultaneously the continuum X-ray radiation passing through different filters. Using a diagnostic tool consisting of a channel multiplier array associated with a conventional image-converter camera, X-ray framing pictures with 10 nsec exposure time are obtained. Correlations between neutron and X-ray emissions are discussed. The optical emission during the compression phases is recorded by an image-converter streak camera observing the axial region through a 100-micron slit parallel to the axis. In this way the radial oscillations and the axial motion of the plasma are studied. A diagnostic method allows the simultaneous determination of both the electron temperature and density using time-resolved, relative, spectroscopic measurements on suitably chosen impurities lines. Author (NSA)

N71-38446# Imperial Coll. of Science and Technology, London (England).
NONADIABATIC IONS IN THE DISTRIBUTION FUNCTION FROM SELF-CONSISTENT CALCULATIONS OF THE PLASMA FOCUS
D. E. Potter and M. G. Haines 17 Jun. 1971 12 p refs Presented at the 4th Conf. on Plasma Phys. and Controlled Nucl. Fusion Res., Madison, Wis., 17 Jun. 1971
(Conf-710807-43; CN-28/D-8) Avail: AEC Depository Libraries

A three-dimensional simulation in phase space of the ions in the plasma focus demonstrated that, in some modes of operation of the experiment, the ion distribution function has two components. Most of the ions are in a quasi-thermal equilibrium, but a small component of the distribution function is accelerated to high energies. The interaction of this high-energy component with the background ions yields a high neutron emission and, in particular, gives rise to an anisotropy in the energies of the neutron emission. Previous two-dimensional magnetohydrodynamic simulations of the dense plasma focus have, in many respects, agreed quantitatively with experiment. The MHD

simulations however, while describing a thermonuclear neutron emission, have not been able to account for the experimentally observed anisotropic neutron emission. The numerical experiments of a magnetohydrodynamic focus have shown that, at high bank energies and lower densities, the ions become collisionless in the plasma focus. In the present research, the simulation is reported of 20,000 ion particles that interact in the self-consistent electromagnetic field of an electron fluid. Author (NSA)

N71-38447# Imperial Coll. of Science and Technology, London (England). Dept. of Physics.
NUMERICAL AND LABORATORY EXPERIMENTS IN THE POLYTRON CONFIGURATION
M. L. Watkins, D. F. Potter, J. D. Kilkenny, M. G. Haines, and A. E. Dangor 17 Jun. 1971 14 p refs Presented at the 4th Conf. on Plasma Phys. and Controlled Nucl. Fusion Res., Madison, Wis., 17 Jun. 1971
(Conf-710807-44; CN-28/D-9) Avail: AEC Depository Libraries

A two-dimensional MHD two-fluid numerical model was constructed to simulate the plasma behavior in the r-z plane of a linear Polytron--a multi-cusped pinch device in which the plasma flows through the cusps. Laser-scattering diagnostics are being employed on the laboratory toroidal experiment in order to measure the electron temperature and density, enabling direct comparison with the numerical model. Magnetic-probe measurements in the ring cusp plane show that the axial current density component is confined to the magnetic axis. From the line intensity of argon 4 radiation, an axial asymmetry about the ring cusp was found and confirmed by the numerical model. Toroidal effects were also observed, namely the preferential outward drift of the plasma in the later stages of the discharge and the associated vertical shift of the plasma, which is periodic with the radial magnetic field. Author (NSA)

N71-38448# Institut fur Plasmaphysik G.m.b.H., Garching (West Germany).
MHD-STABILITY OF AXISYMMETRIC PLASMAS
G. Kuppers, D. Pfirsch, and H. Tasso 17 Jun. 1971 14 p refs Presented at 4th Conf. on Plasma Phys. and Controlled Nucl. Fusion Res., Madison, Wis., 17 Jun. 1971
(Conf-710807-35; CN-28/F-14) Avail: AEC Depository Libraries

A class of axisymmetric magnetohydrostatic Tokamak-like equilibria is considered. In these equilibria, the plasma is surrounded by a vacuum and a perfectly conducting wall. Test functions, which are modified eigenfunctions for similar cylindrical equilibria, are used. The existence of nonlocalized higher m instabilities below the Kruskal limit can be proved exactly. An underestimate of their growth rate can also be given. In an actual device, a resistive limiter could decrease the growth rate of these instabilities, but they can still enhance the plasma losses. A rough estimate of these losses leads to much higher values than given by the banana diffusion formula. In a fusion device, no limiter should touch the plasma, and the instabilities found will probably be very dangerous to the confinement. In addition, Mercier's criterion is computed for an exact class of MHD equilibria containing possibly elliptical cross sections. Author (NSA)

N71-38449# Kernforschungsanlage, Juelich (West Germany). Inst. fuer Plasmaphysik.
TOROIDAL HIGH BETA EXPERIMENTS IN COMPACT AXISYMMETRIC CONFIGURATIONS
H. J. Baltz, L. Jenicke, P. Noll, U. Plantikow, F. Send et al 17 Jun. 1971 14 p refs Presented at the 4th Conf. on Plasma Phys. and Controlled Nucl. Fusion Res., Madison, Wis.
(CN-28/J-2; Conf-710807-114) Avail: AEC Depository Libraries

Plasmas heated by fast-rising and confined by slow-decaying magnetic fields were studied in axisymmetric toroidal configurations. Small aspect ratios R/a (R = major radius, a = characteristic minor dimension) are chosen to reach relatively high current densities and to confine plasmas of higher beta below the Kruskal-Shafranov limit. In the first experiment (helical hard-core theta pinch), plasmas with temperatures T approximately 20 eV, densities n > 10 to 16th power/cu cm and strongly elliptical (typically b/a = 3) cross sections are produced at the end of the fast compression. By adjusting the voltages and currents of the hard core and the theta coil, and the time-delay between switching the banks, R can be varied and the net plasma momentum in r direction can be made approximately 0 at the end of the dynamic phase. Slower variations of R, resulting from the diffusion of the toroidal field into the plasma (beta decreases down to 15% in a few microsec), and from the contraction of the plasma cross section in the z direction, occur later. They can be controlled by programming the hard-core current. Theoretical results on the equilibrium plasma configuration agree with the result of magnetic probe and optical measurements, which indicate further some triangular deformation of the plasma cross section. Author (NSA)

N71-38450# Akademiya Nauk URSR. Kharkov. Fiziko-Tekhnicheskii Inst.
BEHAVIOUR OF A HIGH-TEMPERATURE PLASMA UNDER CURRENT HEATING IN THE HIGH SHEAR STELLARATOR URAGAN
A. G. Dikii, Dzh. G. Gorman, V. M. Zaitsev, G. V. Zelenin, V. D. Kotsubenov et al 17 Jun. 1971 22 p refs In RUSSIAN Presented at the 4th Conf. on Plasma Phys. and Controlled Nucl. Fusion Res., Madison, Wis.
(CN-28/H-11; Conf-710807-111) Avail: AEC Depository Libraries

The following plasma parameters were measured: electron density by means of a phase meter, electron temperature on the basis of the plasma conductivity, and the ratio of the intensities of the spectral lines of helium. The radial distribution of the electron density and temperature was measured with the help of electric probes. Under some conditions control measurements were made of the radial distributions of the electron temperature and concentration on the basis of the Thomson scattering of light from a ruby laser. Results are given of measurements of the energy lifetime and the charged-particle lifetime as a function of the configuration of the magnetic field in the stellarator. When measuring the charged-particle lifetime, account was taken of the effect of ionization by the spectroscopic method. In typical operating regimes the electron density attained 10 to the 13th power/cu cm and the electron temperature up to 100 eV.
Author (NSA)

N71-38451# Academy of Sciences (USSR), Moscow.
EVALUATION OF THE POSSIBILITIES OF USING A POWERFUL BEAM OF RELATIVISTIC ELECTRONS FOR THERMONUCLEAR FUSION
M. V. Babykin, E. K. Zavoiskii, A. A. Ivanov, and L. I. Rudakov 17 Jun. 1971 16 p refs In RUSSIAN; ENGLISH summary Presented at 4th Conf. on Plasma Phys. and Controlled Nucl. Fusion Res., Madison, Wis., 17 Jun. 1971
(CN-28/D-10; Conf-710807-48) Avail: AEC Depository Libraries

For reducing the amount of energy and the beam strength required to initiate a thermonuclear reaction, it is proposed to heat the plasma in a shell of heavy material hindering rapid expansion, as a result of which the critical energy can be reduced to 100,000 J and the critical power to 10 to the 14th power W. Contrary to what applies in the case of the laser method of heating, this is possible thanks to the fairly high penetrating power of relativistic electrons and the low thermal conductivity of the heated plasma at the wall due to the presence of the magnetic field created by the beam. For focusing of the beam, it is proposed to make use of the magnetic field of the beam formed as a result of the partial dissipation of the reverse current in the plasma. As it is frozen in the plasma, the magnetic field confers macroscopic stability on the beam. Calculations show that plasma having the density of a solid deuterium-tritium mixture can be heated by means of ohmic dissipation. Author (NSA)

N71-38452# Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Stuttgart (West Germany). Institut fuer Plasmadynamik.
RADIATIVE ENERGY TRANSPORT IN A PLASMA REACTOR (GAS-CORE REACTOR) [STRAHLUNGSTRANSPORT IN EINEM PLASMA-REAKTOR]
S. Kelm May 1970 35 p refs In GERMAN; ENGLISH summary
(DLR-FB-70-18) Avail: AEC Depository Libraries

The basic theory for the calculation of the radiation field and radiation flux is treated for a known temperature distribution in the plasma. The temperature distribution is then determined in the plasma of an uranium-plasma reactor using the energy equation in which the radiation flux and energy sources are considered. The calculations yield a temperature of 22,000 K for the middle of the reactor. The total radiative power which leaves the plasma is reduced considerably despite the very high temperatures at the middle of the reactor. This is because the temperature of the black body radiation near the walls is lower than 7000 K and because reflecting walls (liquid lithium) are assumed. The results show that the optical radiation in such a reactor does not destroy the inner walls and thus, such an energy system can be realized if the only problem is that of optical radiation. Author (NSA)

N71-38453*# Plasmadyne Corp., Santa Ana, Calif.
INVESTIGATION OF PULSED QUASI-STEADY MPD ARC JETS Technical Report, 26 Jun. 1970 - 26 Jun. 1971
A. C. Ducati and R. G. Jahn Jun. 1971 112 p refs
(Contract NAS1-10140)
(NASA-CR-111970; FR-081-10140) Avail: NTIS CSCL 20I

Evaluation of MPD arc thrusters operating in the quasi-steady mode and using electrode vapor as the propellant is discussed. A primary goal of the program is to determine the performance potential of this type of engine by measurement of the main performance parameters including the direct measurement of total impulse. Most of the effort has been directed toward the development of a propulsion system and a test facility that will permit efficient testing with the desired environmental conditions. Preliminary performance data have been obtained, and are reported and discussed. Author

N71-38454# Austin Research Associates, Inc., Tex.
THEORY OF STRONG TRAPPED PARTICLE TURBULENCE
J. R. Thompson, W. E. Drummond, M. L. Sloan, and H. V. Wong (Texas Univ., Austin) 17 Jun. 1971 33 p refs Presented at 4th Conf. on Plasma Phys. and Controlled Nucl. Fusion Res., Madison, Wis., 17 Jun. 1971 Sponsored in part by AEC
(Contract F44620-70-C-0087)
(Conf-710607-60; CN-28/E-12) Avail: NTIS

A model is presented for the final state of the streaming instability driven by a dc electric field in a cold collisionless plasma. This state consists of large amplitude traveling electric field fluctuations, which limit electron runaway by trapping most electrons. Poisson's equation dictates the existence of a few untrapped electrons, which may be arbitrarily presumed to be in a strip just outside the separatrix, without significantly influencing the velocity or energy of the turbulent wave. The ions are considered in the adiabatic approximation. The time dependence of this state is examined through an ansatz of multiple time scaling. One finds a transition between adjacent metastable states, which proceeds slowly compared to the time scale of wave decay. The trapping of the bulk electrons appears to be dynamically maintained with the ions remaining marginally untrapped. Author (NSA)

N71-38455# Gulf General Atomic, San Diego, Calif.
PLASMA CONFINEMENT IN THE DC OCTOPOLE
Masaji Yoshikawa, Tihiro Ohkawa, John R. Gilleland, and Teruo Tamano 17 Jun. 1971 15 p refs Presented at the 4th Conf. on Plasma Phys. and Controlled Nucl. Fusion Res., Madison, Wis., 17 Jun. 1971
(Contract AT(04-3)-167)
(Conf-710607-3) Avail: NTIS

The plasma in the dc octopole decays in two successive stages: the collisional regime and then the collisionless regime. The measured diffusion coefficient varies linearly with the density and as -2 power of the octopole field. The values of the coefficient are within a factor of three of the theoretical values for the classical diffusion. In the collisionless regime, the density decays exponentially. The confinement time is 0.4 sec for the hydrogen plasma with the electron temperature of 0.5 eV. The plasma losses to the supports and to the walls are comparable. The confinement time is affected by the following parameters: (1) impurity gas pressure, (2) ion mass, (3) electron temperature, (4) field errors, and (5) voltages applied to the particle loss collectors. The confinement time is shortened by the presence of the oxygen-containing gas such as O2, H2O, and CO2.
Author (NSA)

N71-38456# Wisconsin Univ., Madison.
PLASMA INJECTION, HEATING, CONFINEMENT, AND LOSSES IN MULTIPOLE STRUCTURES
D. W. Kerst, H. K. Forsen, D. M. Mead, D. Lencioni, H. De la Fuente et al 17 Jun. 1971 13 p refs Presented at the 4th Conf. on Plasma Phys. and Controlled Nucl. Fusion Res., Madison, Wis., 17 Jun. 1971 Sponsored by AEC
(Conf-710607-2) Avail: NTIS

Plasma behavior and losses to the walls and to the surfaces of the isolated levitated hoops in a toroidal octupole were examined for gun-injected and for microwave-produced plasmas. Methods of plasma focusing by a magnetic lens, which increases the gun plasma-stream density by a factor of 40, are applied to the octupole to raise the density. It was discovered that ECRH also generates hot ions in the levitated octupole. Thin striped multielectrode plasma collectors measure losses to surfaces with minimal mechanical or electrical disturbance to the body of the plasma, and a modulated light beam was used to transmit signals outward from an isolated hoop. Losses to the hoop are sensitive to the time variation of B. Injection inside the confinement region of the small octupole was used with small plasma sources to produce densities of 10 to the 13th power/cu cm. These studies show that stability and trapping efficiency are dependent on the location and orientation of the injector, but not on the density. A toroidal magnetic field of 1000 gauss is being added to the levitated octupole. Author (NSA)

N71-38457# Massachusetts Inst. of Tech., Cambridge.
TURBULENCE IN CONFINED PLASMAS AT HIGH ELECTRIC FIELDS
A. Bers, B. Coppi, T. Dupree, R. Kulsrud (Princeton Univ., N. J.), and F. Santini (Stichting Fundamenteel Onderz. Mater., Neth.) 17 Jun. 1971 23 p refs Presented at the 4th Conf. on Plasma Phys. and Controlled Nucl. Fusion Res. Madison, Wis., 17 Jun. 1971 Sponsored in part by Euratom-FOM
(Contracts AT(30-1)-3980; F44620-69-C-0033)
(Conf-710607-64; CN-28/E-16) Avail: NTIS

Magnetically confined plasmas carrying a relatively large current in the direction of the main magnetic field are considered in regimes where the applied electric field is larger than the runaway critical field. The plasma is assumed to be turbulent with a relatively low fluctuation level induced by ion sound waves, Langmuir waves, and ion cyclotron waves. Three aspects of the problem are examined: (a) transfer of momentum within the electron distribution from superthermal velocities to thermal velocities, i.e., the inhibition by turbulence of the runaway process; (b) anomalous (larger than collisional) heating of the ion energy distribution tail; and (c) transfer of momentum from slow electrons to ions by ion-sound waves and classical collisions.
Author (NSA)

N71-38458# Oak Ridge National Lab., Tenn.
UNDERSTANDING TURBULENT ION HEATING IN THE OAK RIDGE MIRROR MACHINE BURNOUT 5
I. Alexeff, L. A. Berry, J. M. Dudley, K. G. Estabrook, A. Hirose et al 17 Jun. 1971 16 p refs Presented at the 4th Conf. on

Plasma Phys. and Controlled Nucl. Fusion Res., Madison, Wis., 17-23 Jun. 1971
(Conf-710607-67; CN-28/E-14) Avail: NTIS

Theoretical calculations show that a variety of crossed-field instabilities can heat ions effectively. Such instabilities are caused by radial density gradient, or shear in azimuthal rotation, ion-electron collisions, or the presence of two ion species. To study the heating process, the following were used: a high-speed auto- and cross-correlator with an upper frequency limit of 25 GHz; electric field-induced emission from the satellites of normally forbidden helium spectral lines - a technique that yields electric field intensity, polarization, and frequency; soft X-ray counters that observe the spreading and deceleration of the electron beam into the mirror throats; a charge-exchange analyzer that measures both the spatial and temporal behavior of the hot-ion plasma for ions in the energy range 0.5 to 20 keV, and for any desired mass; and a D-D reaction rate monitor sensitive to either 3 MeV protons or 1 MeV tritons.
Author (NSA)

N71-38459# Princeton Univ., N.J. Plasma Physics Lab.
IMPLICATION OF PSEUDOCLASSICAL DIFFUSION FOR TOROIDAL CONFINEMENT DEVICES
S. Yoshikawa and N. C. Christofilos (Calif. Univ., Livermore. LRL) 17 Jun. 1971 18 p refs Presented at the 4th Conf. on Plasma Phys. and Controlled Nucl. Fusion Res., Madison, Wis., 17 Jun. 1971
(Contract AT(30-1)-1238)
(Conf-710607-71; CN-28/F-1) Avail: NTIS

Upper limits on transport coefficients, due to fluctuations and convective cells, are derived using quasi-linear approximations and results are compared with experiment. Diffusion across the magnetic field is found to increase over classical diffusion. The particle confinement time is determined essentially by the equivalent toroidal current flowing in the plasma. Two Astron configurations with toroidal fields are considered. One is essentially a spherator with the ring replaced by an E-layer, which also heats the plasma. The E-layer has the special properties, due to the toroidal field, that synchrotron radiation is greatly reduced and the ring current can greatly exceed the Lawson limit. In the other configuration, the combination of E-layer and toroidal field creates a toroidal minimum-B geometry with the advantages that trapped-particle instabilities are eliminated and the plasma poloidal beta is increased.
Author (NSA)

N71-38460# Los Alamos Scientific Lab., N.Mex.
THEORY OF TURBULENT HEATING AND ANOMALOUS DIFFUSION IN PINCH PLASMAS
D. Forslund, R. Morse, and C. Nielson 17 Jun. 1971 16 p refs Presented at the 4th Conf. on Plasma Phys. and Controlled Nucl. Fusion Res., Madison, Wis., 17 Jun. 1971
(Contract W-7405-eng-36)
(Conf-710607-66) Avail: NTIS

The large anomalous diffusion and resistivity seen in the compression of high-temperature-pinch plasmas and in collisionless shock waves is shown to be consistent with the nonlinear development of the electron cyclotron drift instability. Numerical simulations provide the basis for a detailed nonlinear or turbulence theory, and scaling rules for sheath thicknesses and heating rates are obtained.
Author (NSA)

N71-38461# California Univ., Berkeley. Lawrence Radiation Lab.
PLASMA PRODUCTION BY NEUTRAL BEAM INJECTION IN MIRROR SYSTEMS
K. H. Bertner, W. S. Cooper, III, C. C. Damm, K. W. Ehlers, A. H. Futch et al 11 May 1971 18 p refs Presented at the IAEA Conf. on Plasma Physics and Controlled Nuclear Fusion Res., Madison, Wis., 17-23 Jun. 1971
(Conf-710607-68; CN-28/G-11; UCRL-72880) Avail: NTIS

Injection of energetic neutral atoms is the most promising method so far proposed for maintaining a fusion plasma, especially in mirror systems. Neutral injection studies are focused on two questions: (1) Whether a fusion-density plasma can be produced by buildup from low levels using neutral beams; and (2) Whether a high-density plasma can be maintained by neutral injection. The Baseball II experiment attacks the first question by means of a programmed buildup. The second question can be answered most readily in experiment, where a high density plasma is created by pulsed methods. The key requirement for this test is an intense pulsed neutral beam. To this end the design of an ion source to produce a 10 A, 30 msec pulsed beam of 20 keV deuterium atoms is described. The source utilizes extraction electrodes based on computed ion trajectories and a special expanded arc plasma.
Author (NSA)

N71-38462# California Univ., Livermore. Lawrence Radiation Lab.
PLASMA CONTAINMENT IN THE LRL 2X EXPERIMENT
F. H. Coensgen, W. F. Cummins, V. A. Finlayson, W. E. Nexsen, Jr., and T. C. Simonen 14 May 1971 16 p refs Presented at 4th Conf. on Plasma Phys. and Controlled Nucl. Fusion Res., Madison, Wis., 17-23 Jun. 1971 Sponsored by AEC
(Conf-710607-69; CN-28/G-12; UCRL-71882) Avail: NTIS

An open-ended magnetic well system was filled with deuterium plasma through the use of programmed pulsed magnetic fields to trap and compress plasmas injected along a constant magnetic field. Containment of the deuterium plasma was extended by nearly a factor of two relative to previously obtainable values (to times greater than 2 msec) by improvements that reduced the late influx of impurities. The observed evolution of density and ion energy was compared with classical mirror losses predicted on the basis of coulomb collisions. These calculations were performed through the use of a two-dimensional code that solves the complete Fokker-Planck equations for ions, including electron cooling of ions and ambipolar potential. This experiment was rebuilt in order to increase the magnetic well depth, mirror ratio, and ion temperature as well as to reduce wall effects, which limited the density and energy of the injected plasma in the previous device.
Author (NSA)

N71-38463# California Univ., Livermore. Lawrence Radiation Lab.
EXPERIMENTAL AND COMPUTATIONAL INVESTIGATIONS OF THE DIRECT CONVERSION OF PLASMA ENERGY TO ELECTRICITY
R. W. Moir, W. L. Barr, R. P. Freis, and R. F. Post 13 May 1971 20 p refs Presented at 4th Conf. on Plasma Phys. and Controlled Nucl. Fusion Res., Madison, Wis., 17-23 Jun. 1971 Submitted for publication; sponsored by AEC
(Conf-710607-126; CN-28/K-1; UCRL-72879) Avail: NTIS

Energy is recovered from mirror end losses by expansion in static magnetic fields (to convert perpendicular energy components to parallel), separation of ions from electrons, and, finally, deceleration and selective collection of the particles after each has lost most of its original kinetic energy. Analysis indicates that overall efficiencies of about 90% might be attainable. In the system being investigated, the energydependent focusing property of periodic electrostatic lenses aids the separation. Computer-derived designs were tested in scaled laboratory experiments, in which variable-energy ion beams were used to study a 22-cell collector system in detail. Under one set of operating conditions the measured efficiency averaged at constant current density over a range of 2 in energy was 88%, whereas computer-simulation calculations for the same case gave 92%; the ideal theoretical maximum efficiency under these conditions would be 97%.
Author (NSA)

N71-38464# California Univ., Livermore. Lawrence Radiation Lab.
PLASMA PRODUCTION AND HEATING IN THE SUPERCONDUCTING LEVITRON
O. A. Anderson, D. H. Birdsall, C. W. Hartman, E. B. Hooper, Jr., R. H. Munger et al 27 May 1971 18 p refs Presented at 4th Conf. on Plasma Phys. and Controlled Nucl. Fusion Res., Madison, Wis., 17-21 Jun. 1971 Submitted for publication;

sponsored by AEC
(Conf-710607-9; CN-28/A-8; UCRL-72886) Avail: NTIS

The device has a floating superconducting ring with 40-cm major radius and 5-cm minor radius, which carries up to 600-kA current. Toroidal field is provided by a current of up to 1 MA. Six poloidal field coils are used to shape the magnetic surfaces to obtain field configurations with strong shear. Large area surfaces at liquid-helium temperature, which are not directly exposed to the plasma, provide ultrahigh vacuum. Methods of production and heating of dense plasma with appreciable beta were studied using a classical diffusion and thermal conduction model which includes trapped particle effects. Computations were made both for heating by an initial hot electron plasma and for energetic neutral injection. Author (NSA)

N71-38465# California Univ., Livermore. Lawrence Radiation Lab.
TRAPPING EXPERIMENTS IN THE ASTRON
N. C. Christofilos, W. C. Condit, Jr., T. J. Fessenden, R. E. Hester, S. Humphries et al 10 Jun. 1971 23 p refs Presented at 4th Conf. on Plasma Phys. and Controlled Nucl. Fusion Res., Madison, Wis., 17-23 Jun. 1971 Submitted for publication Sponsored by AEC
(Conf-710607-10; CN-28/A-9; UCRL-72894) Avail: NTIS

The location of the trapping region was moved 9.5 m from the injection point to prepare for experiments in which pulses are overlapped to build up an E-layer with field reversal. This was made possible by increasing the energy of the injected electrons to 6 MeV. By trapping this far from the inflector, it is possible to use a vacuum field which has a 10% deep well with small radial gradients. Single-pulse trapping experiments with these deep, symmetric traps have produced E layers with 5% field reversal (diamagnetic strength 5% of the vacuum field). The first electron pulse is always lost to generate a thin plasma, while the second and third pulses have been stacked. The total circulating current in each of the stacked pulses is 1500 A, thus the circulating current of the E layer formed with two overlapped pulses is 3000 A. The diamagnetic strength is 7%. No additional losses or reduction of the trapping efficiency were observed in stacking the second pulse. Author (NSA)

N71-38466# California Univ., Los Angeles.
REMOTE PLASMA CONTROL, HEATING, MEASUREMENTS OF ELECTRON DISTRIBUTION, AND TRAPPED PARTICLES BY NONLINEAR ELECTROMAGNETIC INTERACTIONS
A. Y. Wong, F. F. Chen, N. Booth, D. L. Jassby, R. Stenzel et al 17 Jun. 1971 9 p refs Presented at 4th Conf. on Plasma Phys. and Controlled Nucl. Fusion Res., Madison, Wis., 17 Jun. 1971 Sponsored by AEC and AFOSR
(Conf-710607-25; CN-28/B-15) Avail: NTIS

Nonlinear electromagnetic interactions with plasmas are generalized to include excitations at both cutoffs and resonances for extraordinary and ordinary modes of propagation. Experimental confirmations are presented. The collisionless and efficient nature of a double resonance scheme, in which high frequency electron resonant modes couple to low frequency resonant ion modes, is exploited for plasma control and heating of plasma ions when a direct coupling to ion modes is not feasible. A new method of measuring electron velocity distribution functions at various radii of a fusion plasma is presented in which the cross sections of laser scattering are dramatically increased. Finally, the electromagnetic excitation and detection of magnetically trapped particles via the echo technique are examined. Author (NSA)

N71-38467# Columbia Univ., New York.
PLASMA HEATING BY STRONG SHOCK WAVES
Y. G. Chen, C. K. Chu, R. A. Gross, E. Halmoy, P. Moriette et al 17 Jun. 1971 16 p refs Presented at 4th Conf. on Plasma Phys. and Controlled Nucl. Fusion Res., Madison, Wis., 17 Jun. 1971
(Contracts AT(30-1)-3954; F44620-71-C-0010)
(Conf-710607-120; CN-28/J-8) Avail: NTIS

About 10,000 cu cm of plasma were created by fast collisional shock waves in an electromagnetic shock tube. The speed of these shock waves corresponded to an acoustic Mach number of 3,200 and an Alfven Mach number of 15. A preshock transverse magnetic field was used to keep the shock thickness small and retard plasma interaction with the walls. Separation of the transverse ionizing shock wave from the driving current was clearly observed, and a hot dense plasma was created behind the shock wave. The state of this plasma was determined by laser interferometer measurements, X-ray bremsstrahlung spectra, a particle energy analyzer, probes and neutron detectors. Measured shock thickness agreed with calculations made from a two-fluid MHD computer code employing classical plasma transport properties. The calculated structures of these collisionless shock waves predict that the ion temperature substantially exceeds the electron temperature. Author (NSA)

N71-38468# Cornell Univ., Ithaca, N.Y.
APPLICATION OF INTENSE RELATIVISTIC ELECTRON BEAMS TO ASTRON-TYPE EXPERIMENTS
M. L. Andrews, H. Davitian, H. H. Fleischmann, R. E. Kribel, B. R. Kusse et al 17 Jun. 1971 21 p refs Presented at 4th Conf. on Plasma Phys. and Controlled Nucl. Fusion Res., Madison, Wis., 17 Jun. 1971
(Contracts AT(30-1)-4077; N00014-67-A-0077-0003)
(Conf-710607-12; CN-28/A-11) Avail: NTIS

Electron beams of 10 to 30 kA having energies of 300 to 400 keV and an angular divergence of a few degrees are injected into magnetic fields of 200 to 300 gauss. When injecting into a homogeneous magnetic field, optical observation shows the beam to remain self-focused and to propagate in spirals along the field lines approximately corresponding to the average electron energy and injection angle. Also, reflection from a mirror and partial trapping between two mirrors bracketing the injector is observed. Well-shielded magnetic probes on the field axis indicate diamagnetic field changes of up to 40% of the original field when injecting into a homogeneous field. In the double-mirror arrangement, field changes of up to 140% are observed. The radial distribution of the magnetic field indicates a thickness of the current layer of the same order as the radius. Experiments on the trapping in regions separate from the injector and on the influence of pre-ionization on the beam behavior are discussed. Author (NSA)

N71-38469# Los Alamos Scientific Lab., N.Mex.
THETA-PINCH EXPERIMENTS WITH HELICAL EQUILIBRIUM, FIELDS IN A 5-METER TOROIDAL SECTOR AND IN A 3-METER LINEAR DEVICE
S. C. Burnett, W. R. Ellis, C. F. Hammer, C. R. Harder, H. W. Harris et al 17 Jun. 1971 19 p refs Presented at the 4th Conf. on Plasma Phys. and Controlled Nucl. Fusion Res., Madison, Wis., 17-23 Jun. 1971
(Contract W-7405-eng-36)
(Conf-710607-116; CN-28/J-4; LA-DC-12208) Avail: NTIS

Experiments are reported on a pinch sector comprising one-third of the Scyllac torus of major radius R = 237.5 cm and plasma radius a approximately equal to cm. Equilibrium is obtained by balancing the toroidal force by means of a 1 = 1 helical field, which produces a helical shift of the plasma column approximately equal to its radius and a small admixture of 1 = 0 field. Both fields have a wavelength of 33 cm. End effects are not expected to dominate before the lapse of one Alfven (or ion-thermal) transit time from the plasma ends. There is sufficient time to observe the attainment of equilibrium and some of its stability properties. Related experiments on a 3-meter linear theta pinch with superimposed 1 = 1 fields show that only the m = 1, k approximately equal to 0 magnetohydrodynamic (MHD) mode occurs. Author (NSA)

N71-38470# Los Alamos Scientific Lab., N.Mex.
SURVEY OF SCYLLAC THEORY
J. P. Freidberg 17 Jun. 1971 13 p refs Presented at 4th Conf. on Plasma Phys. and Controlled Nucl. Fusion Res., Madison, Wis., 17 Jun. 1971 Sponsored by AEC

(Conf-710607-117; CN-28/J-5) Avail: NTIS

A survey is given of both old and new theoretical results pertaining to the Scyllac experiment. Author (NSA)

N71-38471# Los Alamos Scientific Lab., N.Mex.
RECENT STUDIES OF DENSE PLASMA FOCUS
J. W. Mather, P. J. Bottoms, J. P. Carpenter, K. D. Ware, and A. H. Williams 17 Jun. 1971 13 p refs Presented at the 4th Conf. on Plasma Phys. and Controlled Nucl. Fusion Res., Madison, Wis., 17-23 Jun. 1971 Sponsored by AEC
(Conf-710607-40; CN-28/D-5; LA-DC-12248) Avail: NTIS

Empiricial solutions to the problems of restrike or subsidiary breakdown in the breech if the plasma focus accelerator were found for 50-KV operating voltages. Restrike during the acceleration phase has plagued focus experiments because its occurrence actually short circuits the capacitor energy from the current sheath. Quality control of the Pyrex insulator, electric flux control at the center electrode surface, and lower electric fields across the inter-electrode space are effective measures reducing restrike. The transition from the inverse pinch to the axial rundown phase as well as the fraction of time taken up by the inverse stage relative to the quarter are of concern. These and other dynamical aspects are discussed. There seems to be no single or simple plasma mechanism that can account entirely for the rapid heating of ions and electrons in the plasma focus.
Author (NSA)

N71-38472# Maryland Univ., College Park. Inst. for Fluid Dynamics and Applied Mathematics.
INVESTIGATION OF UNIVERSAL PLASMA INSTABILITIES
Annual Progress Report
1 Jun. 1971 23 p refs
(Contract AT(40-1)-3405)
(ORO-3405-35; APR-6) Avail: NTIS

Work was focused on two problems: the parametric excitation of ion-acoustic waves, primarily experimental work; and analysis of plasma stabilization by so-called open-loop methods, which are to be contrasted with closed-loop or feedback methods. NSA

N71-38473# Maryland Univ., College Park. Inst. for Fluid Dynamics and Applied Mathematics.
LECHER WIRE MICROWAVE SYSTEMS FOR FLOWING PLASMA DIAGNOSTICS
Augustine Yim-Pan Chaung May 1971 62 p refs
(Contract AT(40-1)-3819)
(ORO-3819-5; BN-696) Avail: NTIS

Microwave radiation at approximately 9 GHz was coupled into the plasma for electron density and electron temperature measurements using the Lecher wires. The connection from X-band waveguides to Lecher wires was provided by either a fin-line transition or a tapered parallel plane transition. The fin-line connected Lecher wire was used as a component in an X-band Fabry-Perot interferometer for measuring electron densities ranging from 5 x 10 to the 10th power/cu cm to 10 to the 12th power/cu cm. The tapered parallel plane connected Lecher wire was used as a probing element in a system which measures both the plasma electron density and electron temperature using information obtained from the change in phase, transmission, and reflection in the system during the passage of the flowing plasma. A seven-layer dielectric model was adapted for data analysis, and successful measurements were made on electron density ranging from 5 x 10 to the 10th power to 9 x 10 to the 11th power/cu cm and electron temperature in the range of .5 to 10 eV. Author (NSA)

N71-38474# Transtek Associates, Reading, Mass.
NUMERICAL CALCULATION OF THE MAGNETIC FIELD CONFIGURATION IN A TOKAMAK
A. E. Bazhenova et al Apr. 1971 45 p refs Transl. into ENGLISH from the Russian report IAE-2046 Prepared for Princeton Univ.
(Contract AT(30-1)-1238)
(MATT-Trans-104; IAE-2046) Avail: NTIS

The distribution of a magnetic field holding a toroidal plasma column with radii alpha R, in equilibrium, is calculated in the magnetohydrodynamic approximation. The calculation is performed for the simplest distribution of the longitudinal current J sub phi = Ar + B/r, where A and B are constants characterizing the magnitude of the plasma pressure and its diamagnetism with respect to the longitudinal magnetic field. It was demonstrated that the confining magnetic field is close to uniform. The limiting value of the parameter beta sub j compatible with the condition of confining the plasma and characterizing the ratio of the plasma pressure to the magnetic field pressure of longitudinal current J was calculated. The depth of the mean magnetic well and the angle of rotational transformation were calculated as functions of the plasma pressure, and it was demonstrated that for a pressure close to limiting the crossing of the force lines increases noticeably. A calculation of the confining field created by the currents in the given conductors is presented. Author (NSA)

N71-38475# Princeton Univ., N.J. Plasma Physics Lab.
ROTATING TOROIDAL EQUILIBRIA AND SHOCKS
N. K. Winsor, E. C. Bowers, and J. M. Dawson 17 Jun. 1971 25 p refs Presented at the 4th Conf. on Plasma Phys. and Controlled Nucl. Fusion Res., Madison, Wis., 17-23 Jun. 1971 Sponsored by AEC
(Conf-710607-75; CN-28/F-4) Avail: NTIS

A low-beta axisymmetric fluid model shows enhanced material flux and shock structure for stellarator or low-temperature Tokamak parameters. Numerical calculations agree with analytic results and predict the equilibrium potential distribution, given the radial density distribution. The fluid model includes ion inertia, resistivity, and viscosity, plus the Hall terms in Ohm's law and a tensor pressure in the momentum equation. The magnetic field model includes curvature, rotational transform, and shear. Acoustic, drift, and convective modes are present. Analytic equilibrium calculations show that the material flux is nearly classical when the poloidal rotation speed is small compared to the electron drift velocity. The sign of the potential is determined by a balance between resistivity and viscosity. If resistive effects dominate, the electron flow perpendicular to B becomes small, giving a positive potential on axis. Author (NSA)

N71-38476# Princeton Univ., N.J. Plasma Physics Lab.
FEEDBACK AND DYNAMIC STABILIZATION METHODS AND THEIR POWER REQUIREMENTS: A COMPARATIVE EVALUATION
H. W. Hendel and T. K. Chu 17 Jun. 1971 11 p refs Presented at the 4th Conf. on Plasma Phys. and Controlled Nucl. Fusion Res., Madison, Wis., 17-23 Jun. 1971 Sponsored by AEC
(Conf-710607-24; CN-28/B-14) Avail: NTIS

Experimental results on number of modes stabilized, growth-rate ranges effected, and power required are used to evaluate these nonstatic methods for applications in fusion plasmas. Linear feedback reduces instability amplitude by two orders of magnitude. It is frequency- and mode-selective and most easily used near marginal instability; stabilization of many oscillatory modes simultaneously is difficult. Remote feedback was demonstrated. Nonlinear feedback uses a constant corrective signal whenever the instability amplitude grows above a present level. It may be applied at repetition rates below the instability frequency. Results are comparable to those of linear feedback. However, harmonics or higher modes are easily destabilized. Dynamic methods are observed to stabilize not only many modes of one instability, but also broad-band turbulence and different instabilities simultaneously, in agreement with the interpretation based on generation of a new dynamic equilibrium stable against a class of instabilities. Power requirements may determine feasibility of nonstatic stabilization in fusion plasmas.
Author (NSA)

N71-38477# Princeton Univ., N.J. Plasma Physics Lab.
STABILITY EXPERIMENTS ON THE ST TOKAMAK
J. C. Hosea, C. Bobeldijk, and D. J. Grove 17 Jun. 1971 19 p refs Presented at the 4th Conf. on Plasma Phys. and Controlled Nucl. Fusion Res., Madison, Wis., 17-23 Jun. 1971
(Contract AT(30-1)-1238)
(Conf-710607-78; CN-28/F-7) Avail: NTIS

Two phases of instability are observed on the ST Tokamak: (1) slow-growing, small-amplitude oscillatory modes, followed by (2) fast-growing, sometimes destructive, instabilities that can limit the attainable q value. The results point to the importance of the plasma profile and the relative unimportance of the copper shell for stability. The mode structure and amplitude of the slow-growing oscillations were determined with multiple probes and also with microwave interferometry. When the plasma current is raised to a fixed plateau value, with constant toroidal and vertical magnetic fields, the dominant mode number m in the plateau regime is found to decrease in time while n remains unity. A faster decrease in m is produced by pulsing in gas to cool the edge of the discharge or by operating the machine under less-clean conditions. The modes rotate in the electron diamagnetic drift direction and have frequencies close to the electron diamagnetic frequency. Author (NSA)

N71-38478# Oak Ridge National Lab., Tenn.
HIGH-BETA RELATIVISTIC ELECTRON PLASMAS IN AXISYMMETRIC AND NON-AXISYMMETRIC MIRRORS
R. A. Dandl, H. O. Eason, P. H. Edmonds, A. C. England, G. E. Guest et al 17 Jun. 1971 25 p refs Presented at 4th Conf. on Plasma Phys. and Controlled Nucl. Fusion Res., Madison, Wis., 17-23 Jun. 1971
(Conf-710607-91; CN-28/G-4) Avail: NTIS

Plasmas with kT sub e approximately 1 MeV, n approximately 10 to the 12th power/cu cm, and stored energies as high as 360 joules in a volume of 2 liters were produced and confined in a 2 : 1 mirror trap (ELMO) using simultaneous resonant (35-GHz) and off-resonant (55-GHz) CW microwaves. The stable, steady-state, relativistic electron plasma was confined in an axisymmetric annular region near the midplane of the mirror trap. The self-consistent magnetic field had a minimum in the annular region, so that the main body of the plasma was in a magnetic well. The outer surface of the plasma was in a region of unfavorable curvature and was stabilized by line tying to conducting end walls. The amount of cold plasma required for particle equilibrium exceeded by two orders of magnitude that required for stability. A machine was constructed to study the limitations on equilibrium and stability of a high-beta plasma ring resulting from deformation of the initially axisymmetric mirror trap into one sector of a bumpy torus geometry. Author (NSA)

N71-38479# Oak Ridge National Lab., Tenn.
OAK RIDGE TOKAMAK RESEARCH
C. F. Barnett, J. F. Clarke, R. A. Dory, J. T. Hogan, G. G. Kelley et al 17 Jun. 1971 14 p refs Presented at the 4th Conf. on Plasma Phys. and Controlled Nucl. Fusion Res., Madison, Wis., 17 Jun. 1971
(Conf-710607-26; CN-28/C-1) Avail: NTIS

Research related to the experiment ORMAK is described. The behavior of Tokamak discharges was studied using two-fluid MHD theory augmented where necessary and possible by specific experimental features (banana orbits, impurities, external circuits, etc.). Time-dependent spatially-resolved integration of the ion and electron heat flow equations and Maxwell equations has given data for experimental comparison, for determination of poorly known parameters (resistivity and electron thermal conductivity anomalies, etc.), and for study of sensitivity to parameters normally not adjustable in experiments (scaling laws). The pressure-balance equation was used with these results to determine overall plasma diamagnetism. Initial results are described, including space- and time-resolved laser measurements of electron temperature and density and charge-exchange measurements of ion temperature. Magnetic probes were used to study mode patterns of instabilities and movement of the plasma column. Author (NSA)

N71-38480# Oak Ridge National Lab., Tenn.
USE OF A HOT-ELECTRON TARGET PLASMA FOR ACCUMULATION OF ENERGETIC IONS IN STABILIZED MAGNETIC MIRROR TRAPS
W. B. Ard, R. A. Blanken, R. J. Colchin, J. L. Dunlap, and G. E. Guest 17 Jun. 1971 18 p refs Presented at 4th Conf. on Plasma Phys. and Controlled Nucl. Fusion Res., Madison, Wis., 17 Jun. 1971
(Conf-710607-92; CN-28/G-5) Avail: NTIS

Hot-ion accumulation by injection into target plasmas was examined. Experiments in the INTEREM device use 10-GHz resonant power either alone or in combination with fields at 36 GHz. When resonant power is used alone, high-frequency instabilities associated with the velocity-space anisotropy can be identified. These modes are suppressed by addition of the nonresonant power, which increases the relativistic electron population. Theoretical evaluations indicate this can be sufficient to suppress the modes seen. The results of hot-ion experiments are described in which approximately 50 mA of 1 to 2-keV H(0) are injected into these target plasmas. Author (NSA)

N71-38481# New York Univ., N.Y. Courant Inst. of Mathematical Sciences.
TOROIDAL HIGH BETA EQUILIBRIA
Harold Weitzner 17 Jun. 1971 6 p refs Presented at 4th Conf. on Plasma Phys. and Controlled Nucl. Fusion Res., Madison, Wis., 17 Jun. 1971
(Contract AT(30-1)-1480)
(Conf-710607-118; CN-28/J-6) Avail: NTIS

The equilibrium and stability of large aspect ratio, long helical wavelength high beta toroidal systems are studied in an ordering that permits moderate deformations of the plasma column, includes toroidal effects in the stability analysis, and yields hopeful stability criteria. Author (NSA)

N71-38482# New York Univ., N.Y. Courant Inst. of Mathematical Sciences.
PLASMA CONTAINMENT IN CLOSED LINE SYSTEMS
Harold Grad 17 Jun. 1971 14 p refs Presented at 4th Conf. on Plasma Phys. and Controlled Nucl. Fusion Res., Madison, Wis., 17 Jun. 1971
(Contract AT(30-1)-1480)
(Conf-710607-119; CN-28/J-7) Avail: NTIS

Plasma equilibria with exact magnetic surfaces which are obtained only in configurations with an ignorable coordinate are discussed as well as equilibria with closed magnetic lines which result from a different symmetry, reflection in a plane. The appropriate analytical methods and the ensuing plasma properties which differ profoundly for magnetic-surface and closed-line equilibria are reviewed. A general theory was developed for scalar pressure and guiding-center models, and a number of special results were calculated for a bumpy torus with small toroidal curvature. On occasion, the toroidally perturbed pressure profile developed islands (bananas). Classical resistive diffusion was a typical; the standard procedures failed, and diffusion did not follow the standard 1(B sq) formula. Author (NSA)

N71-38483# Massachusetts Inst. of Tech., Cambridge.
COLLECTIVE MODES IN HIGH CURRENT CARRYING CONFINED PLASMAS
J. Callen, B. Coppi, R. Agazian, R. Gajewski, and D. Sigmar 17 Jun. 1971 28 p refs Presented at 4th Conf. on Plasma Phys. and Controlled Nucl. Fusion Res., Madison, Wis., 17 Jun. 1971
(Contract AT(30-1)-3980; Grant NSF GP-8557)
(Conf-710607-80; CN-28/F-9) Avail: NTIS

Confinement configurations allowing for high plasma current densities are potentially suitable to reach new regimes which are typical of thermonuclear plasmas. The influence of the plasma cross section profile on the maximum current density that can be achieved in two-dimensional toroidal configurations is analyzed. The MHD stability and equilibrium are examined for a plasma column with a conducting shell close to it and with an ellipti

and triangular deformation imposed over a circular cross section profile. Since the configurations of interest also have a low aspect ratio and a large fraction of trapped particles, the stability of collisionless kinetic modes involving trapped particles is studied, taking into account the effect of the electron current.
Author (NSA)

N71-38484# Los Alamos Scientific Lab., N.Mex.
HIGH ENERGY GUN-INJECTED TOROIDAL QUADRUPOLE
J. E. Hammel, I. Henins, R. W. Kewish, Jr., J. Marshall, and A. R. Sherwood 17 Jun. 1971 5 p refs Presented at the 4th Conf. on Plasma Phys. and Controlled Nucl. Fusion Res., Madison, Wis., 17 Jun. 1971 Sponsored by AEC
(Conf-710807-8; CN-28/A-7) Avail: NTIS

A quadrupole device is being used to investigate the trapping and containment of an energetic gun plasma. The quadrupole is designed to contain a peak density of 5 x 10 to the 13th power/cm cu at 2.5 keV within the MHD stable region. Experiments at half design value of the magnetic field have shown that the kilovolt energy gun plasma is trapped by depolarization currents around the coils and that a very high percentage of the gun output can be trapped. The plasma density is measured by a unique Michelson interferometer using CO2 laser light. The energy of the plasma is derived from magnetic pickup loops placed outside the containment region. The leak caused by the dipole guard field was examined by double electric probe measurements. The plasma drift thus inferred is an order of magnitude less than that predicted by a model of Meade or by the author's calculations. Author (NSA)

N71-38485# California Univ., Livermore. Lawrence Radiation Lab.
THEORETICAL STUDY OF E-LAYER AND PLASMA BEHAVIOR IN ASTRON
D. V. Anderson, G. A Benford, M. Brettschneider, J. Killeen, W. A. Newcomb et al 29 Apr. 1971 25 p refs Presented at the 4th Conf. on Plasma Phys. and Controlled Nucl. Fusion Res., Madison, Wis., 17 Jun. 1971 Sponsored by AEC
(Conf-710807-11; CN-28/A-10; UCRL-72681) Avail: NTIS

The injection, equilibrium, and stability of the E layer and confined plasma in Astron are investigated. Self-consistent equilibrium configurations for a collisionless E layer and an ideal plasma fluid were obtained from a numerical solution of Ampere's law, using various models for both the E layer and plasma pressure profiles. The degree of field reversal and the shape of the magnetic well can be varied so as to obtain equilibria with favorable stability properties. The stability of an E layer, alone or in conjunction with a cold background plasma, was analyzed for modes with wavelengths less than or comparable to E layer dimensions. The results are in good qualitative agreement with experimental observations on the precession, negative-mass, and plasma hybrid modes. The most important stabilizing mechanism is seen to be energy spread in the E layer. The stability of the confined plasma is investigated using the MHD energy principle. Author (NSA)

N71-38486# Princeton Univ., N.J. Plasma Physics Lab.
CONFINEMENT OF PLASMAS IN THE SPHERATOR
R. Freeman, M. Okabeyashi, G. Pacher, S. Ripin, J. Schmidt et al 17 Jun. 1971 31 p refs Presented at the 4th Conf. on Plasma Phys. and Controlled Nucl. Fusion Res., Madison, Wis., 17 Jun. 1971
(Contract AT(30-1)-1238)
(Conf-710807-4; CN-28/A-3) Avail: NTIS

A spherator with levitated superconducting ring is described. The ring has a current of 85 kA and can be levitated for periods up to two hours by means of magnetic feedback stabilization. Plasmas were formed by application of electron cyclotron resonance microwave power of up to 1 kW. Gases used were H2, D2, He, and Ar. The electron temperature decays from 10 eV to 0.2 eV in the afterglow. Plasma confinement times of 100 to 200 msec were obtained under the best conditions in the density range 10 to the 10th power to 10 to the 11th power/cu cm. The good plasma confinement can be spoiled by the application of magnetic field perturbations. It was also found that the plasma confinement times are very sensitively dependent on impurity concentration (chiefly H2O). Plasma can also be ohmically heated by electric fields in the poloidal direction. The resulting plasma is almost fully ionized. The electron temperature reaches 20 to 70 eV. The plasma density decay time measured immediately after the ohmic heating pulse is approximately 20 msec. Author (NSA)

N71-38487# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Sukumi (USSR). Fiziko-Tekhnicheskii Inst.
PLASMA PHYSICS AND CONTROLLED THERMONUCLEAR REACTIONS, 1968 - 1969
1970 226 p refs In RUSSIAN
(NP-18901) Avail: AEC Depository Libraries

Studies on the interaction of high-frequency electromagnetic fields with magnetized plasma, high-intensity electron and ion beams, and pulse discharges predominate the 66 subjects of the papers. Several investigations were made to attenuate the magnetohydrodynamic and kinetic instabilities of the plasma by means of high-frequency fields and to heat up the plasma without collisions. In this connection, the mechanism of interaction of large-amplitude alternating fields with the plasma in the skin-layer region was examined. The results revealed that, under the prevailing experimental conditions in toroidal systems, the depth of the skin layer exceeded the classical value by several fold and because of the abnormally high ion temperatures, the level of the ion-acoustic turbulence was not high. This could mean that turbulent processes in the skin layer will not lead to an uncontrolled energy dissipation of the high-frequency fields in the plasma. Author (NSA)

N71-38488# United Kingdom Atomic Energy Authority, Culham (England).
CONVECTIVE MOTION IN THE CLIMAX TOROIDAL QUADRUPOLE DEVICE
A. N. Dellis, J. H. P. C. Megen, R. Prentice, and C. D. King 17 Jun. 1971 15 p refs Presented at the 4th Conf. on Plasma Phys. and Controlled Nucl. Fusion Res., Madison, Wis., 17-23 Jun. 1971
(CN-28/A-6; Conf-710807-7) Avail: AEC Depository Libraries

Plasma confinement in the Climax induced-current toroidal quadrupole was measured during a period of slow field decay giving approximately 15 ms of experimental time. Superimposed on this is a flow across the constant-U flux surfaces, as shown by azimuthal variations in the potential, which produces large-scale convective cells. The major cause of this flow is localized plasma cooling by neutral gas entering from the plasma gun. Simultaneous injection of neutral gas from a replica of the original gun causes the faster decay to reappear and probe measurements near it show a modification of the plasma flow agreeing with the theoretical model. Calculation of the total outward plasma flux shows however, that the convective motion cannot by itself account for the observed plasma loss rate, but is rather a mechanism by which plasma is redistributed inside the trap.
Author (NSA)

N71-38489# Royal Inst. of Tech., Stockholm (Sweden).
PLASMA CONFINEMENT AND HEATING IN THE INTERNAL RING DEVICE F IV
B. Lehnert, J. Bergstroem, M. Bures, E. Tennfors, and S. Wilner 17 Jun. 1971 25 p refs Presented at the 4th Conf. on Plasma Phys. and Controlled Nucl. Fusion Res., Madison, Wis., 17-23 June 1971
(CN-28/A-4; Conf-710807-5) Avail: AEC Depository Libraries

A closed magnetic confinement region of nearly spherical shape is produced in the device F 4 by a ring-shaped internal conductor and a pair of external coils. The internal ring is suspended by magnetically guarded supports. To secure a good confinement, theory predicts that the guiding-center drifts of the plasma particles across the magnetic field must be small compared to the thermal velocity and that the separation

distance of a pair of supports should be small compared to the support length. The azimuthal fluid motions are limited in the fully ionized state, and the plasma is sustained by high-frequency heating, tuned to the magneto-acoustical resonance frequency at about 1.1 MHz. The experiments indicate that magnetic line-tying effects at the outer plasma boundary are essential to the stability of the plasma, that plasma equilibrium becomes possible also in presence of magnetized supports, and that magnetic guarding of the latter reduces the total power losses of the plasma.
Author (NSA)

N71-38490# Commissariat a l'Energie Atomique, Fontenay-Aux-Roses (France). Centre d'Etudes Nucleaires.
VACUUM AND NEUTRAL BEAM PRODUCTION IN THE MULTI-INJECTION EXPERIMENT IN A QUADRUPOLAR COIL [LE VIDE ET LA PRODUCTION DES FAISCEAUX DE NEUTRES DANS L'EXPERIENCE DE MULTI-INJECTION DANS UN LACET QUADRUPOLAIRE]
R. Dei-Cas, A. Bariaud, R. Becherer, J. Drusux, F. Hennion et al Feb. 1971 34 p refs In FRENCH; ENGLISH summary
(EUR-CEA-FC-587) Avail: AEC Depository Libraries

The production system for fast neutral beams for a multi-injection experiment in a quadrupolar coil is described. Vacuum calculations show that it is possible to obtain the initial conditions necessary for the exponentiation of the plasma density: rho sub 0 approximately equal to 10 to the minus 8th power torr for an intensity I approximately equal to 0.25 to 0.75 A. A prototype injector was built to study the possibility of producing ten neutral beams.
NSA

N71-38491# Japan Atomic Energy Research Inst., Tokai.
PLASMA CONFINEMENT IN THE JAERI HEXAPOLE WITH HIGH TOROIDAL FIELD
S. Tamura, H. Yamato, T. Nagashima, M. Yoshikawa, H. Ohtsuka et al 17 Jun. 1971 12 p refs Presented at the 4th Conf. on Plasma Phys. and Controlled Nucl. Fusion Res., Madison, Wis., 17-23 Jun. 1971
(Conf-710607-6; CN-28/A-5) Avail: AEC Depository Libraries

The behavior of a plasma confined in a toroidal hexapole configuration is studied with and without superposition of a toroidal magnetic field. The quasi stationary hexapole field is produced by three current carrying hoops held in place by supports. The average hexapole field strength on the stability limit line is up to 2800 G, which corresponds to an average of 8 gyroradii between the separatrix and the stability limit line for 20 eV hydrogen ions. Plasma, produced either by microwave heating at the electron cyclotron frequency or by a coaxial gun, are stably confined in the hexapole without noticeable fluctuations in the interior of the plasma. The measurement of particle loss shows that most of the plasma is lost across the magnetic field to the hoops and walls for microwave-produced plasmas. The particle lifetime is typically 1.2 msec and is consistent with the result of particle loss measurements. The lifetime of the gun injected plasma at higher magnetic fields is limited by the particle loss to the supports.
Author (NSA)

N71-38492# United Kingdom Atomic Energy Authority, Culham (England).
EXPERIMENTAL STUDY OF COLLISIONLESS SHOCK WAVES
J. W. M. Paul, C. C. Daughney, L. S. Holmes, P. T. Rumsby, A. D. Craig et al 17 Jun. 1971 9 p refs Presented at 4th Conf. on Plasma Phys. and Controlled Nucl. Fusion Res., Madison, Wis., 17-23 Jun. 1971
(Conf-710607-121; CN-28/J-9) Avail: AEC Depository Libraries

Experiments relating to four collisionless shock problems are described. Observations are presented of the interstreaming and interaction of two laser produced plasma plumes, and a laser produced plasma explosion with various background plasmas. The effect of a small magnetic field is also described. These results are related to instability theory and the problem of generating high Mach-number shocks for zero or small magnetic field.
Author (NSA)

N71-38493# United Kingdom Atomic Energy Authority, Culham (England).
EQUILIBRIUM AND MHD STABILITY IN TOKAMAK AND HYBRID SYSTEMS
J. D. Jukes and F. A. Haas 17 Jun. 1971 17 p refs Presented at 4th Conf. on Plasma Phys. and Controlled Nucl. Fusion Res., Madison Wis., 17-23 Jun. 1971
(Conf-710607-82; CN-28/F-11) Avail: AEC Depository Libraries

Axisymmetric, toroidal, plasma eqilibria are examined according to MHD theory. The plasma is assumed to lie in a magnetic field with a strong toroidal component, within a toroidal flux surface of small reciprocal aspect ratio. The flux surfaces are assumed to be nested around a single magnetic axis, and shaping of the minor cross section with up to three harmonics is considered. An expression for the energy perturbation, which gives a stability criterion valid for mode numbers, is derived in a form suitable for further numerical study. Specific results are given only for localized interchange modes in a form containing shear, average magnetic well, and ballooning effects, evaluated for simple, shaped profiles. A feature of shaped flux surfaces is the added shear and well depth they provide in combination with the transform due to the plasma current, whose precise distribution is no longer so critical for stability.
Author (NSA)

N71-38494# Ceskoslovenska Akademie Ved, Prague. Ustav Fyziky Plazmatu.
SOME NONLINEAR PHENOMENA ASSOCIATED WITH HIGH FREQUENCY BEAM PLASMA INSTABILITIES
V. Piffl, P. Sunka, J. Ullschmied, K. Jungwirth, and L. Krlin 17 Jun. 1971 14 p refs Presented at 4th Conf. on Plasma Phys. and Controlled Nucl. Fusion Res., Madison, Wis., 17-23 Jun. 1971
(Conf-710607-59; CN-28/E-11) Avail: AEC Depository Libraries

High frequency instabilities in a beam-plasma system were investigated experimentally. The measurements were performed on two experimental facilities. In one of them the plasma is created independently of the beam, and in the range of parameters examined, only the instability with omega > is excited. In the second facility the plasma is created by the electron beam itself and the process of the plasma buildup, up to the densities when omega sub pe is approximately omega sub ce, is influenced only by the instability at the frequencies omega < omega sub ce. The working gas is argon. In both cases the plasma is immersed in a homogeneous magnetic field and the number density of the plasma varies within the limits 10 to the 9th power to 10 to the 12th power cu cm.
Author (NSA)

N71-38495# Academy of Sciences (USSR), Moscow. Inst. Vysokikh Temperatur.
THEORY OF PLASMA CONFINEMENT IN A TOKAMAK AT HIGH TEMPERATURES
A. A. Galeev and R. Z. Sagdeev 17 Jun. 1971 21 p refs In RUSSIAN; ENGLISH summary Presented at the 4th Conf. on Plasma Phys. and Controlled Nucl. Fusion Res., Madison, Wis., 17-23 Jun. 1971
(Conf-710607-34; CN-28/C-11) Avail: AEC Depository Libraries

The dynamics of the plasma in a Tokamak are examined in cases where the path lengths are so long that the particles can justifiably be divided into blocked and in-transit categories. The kinetic equilibrium of the plasma in a Tokamak is considered. In the determination of the equilibrium configuration of the magnetic field, account is taken of the banana currents of blocked and in-transit particles, which are similar to the Larmor current in a homogeneous magnetic field. Expressions are derived for the values of the diamagnetic signal and the displacement of the column measured during Tokamak experiments. The dynamics of the plasma column are calculated on the basis of equations for the heat balance and particles with neoclassical transfer coefficients. The difference between the neoclassical and experimental values of the transfer coefficients in dilute plasma is analyzed. Models of the anomalous transfer due to low frequency turbulence of the in-transit and blocked particles are discussed.
Author (NSA)

N71-38496# Academy of Sciences (USSR), Moscow.
EFFECT OF AN ELECTRIC FIELD ON TRANSFER PROCESSES IN AXIALLY SYMMETRIC MAGNETIC TRAPS
L. M. Kovrizhnykh 17 Jun. 1971 21 p refs In RUSSIAN; ENGLISH summary Presented at the 4th Conf. on Plasma Phys. and Controlled Nucl. Fusion Res., Madison, Wis., 17-23 Jun. 1971
(Conf-710807-28; CN-28/C-5) Avail: AEC Depository Libraries

By solving the kinetic equation in the drift approximation, expressions are derived for the particle flux and energy density across a strong magnetic field in axially symmetric systems of the Levitron- or Tokamak-type. In addition to the longitudinal accelerating electric field, which is responsible for creating the longitudinal current, account is taken of the presence of a quasi-static electric field directed along the minor radius and resulting from ambipolarity of dispersion. Both the case of very low collision frequencies (lower than the characteristic frequency of the azimuthal motion of the blocked particles) and that of intermediate and high collision frequencies are considered. It is shown that, if either the thermal velocity of the particles or the ratio of the poloidal magnetic field to the longitudinal magnetic field is fairly large, then allowance for the radial electric field corresponds to allowance in the flux expressions for corrections of the next higher order. Author (NSA)

N71-38497# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Sukumi (USSR). Fiziko-Tekhnicheskii Inst.
PLASMA HEATING AND STABILITY IN A COMBINED PINCH
I. F. Kvartskhava, G. G. Zukakishvili, Yu. V. Matveev, Yu. S. Gvaladze, N. A. Razmadze et al 17 Jun. 1971 22 p refs In RUSSIAN; ENGLISH summary Presented at the 4th Conf. on Plasma Phys. and Controlled Nucl. Fusion Res., Madison, Wis., 17-23 Jun. 1971
(Conf-710807-13; Cn-28/B-1) Avail: AEC Depository Libraries

Results of experiments with a discharge chamber of small diameter (d = 6.6 cm) with no filaments in the plasma are considered. The length of the theta-pinch magnetic coil is L = 21 cm. The longitudinal current of the z pinch varied within the range 5 to 50 kA. The half-period of the discharge was the same for both pinches; the two discharges were triggered simultaneously in an already existing plasma with electron temperature approximately 5 eV. The measurements showed that for currents not exceeding the Kruskal-Shafranov value a plasma is stable throughout the half-period of the discharge. Investigation of the axial and radial distributions of the neutron yield showed that neutrons are emitted from a plasma column with diameter approximately 1.8 cm and length approximately 5 cm, which coincides with the region of soft-X-ray emission. Author (NSA)

N71-38498# Texas Technological Univ., Lubbock. Dept. of Electrical Engineering.
THE 14TH MEETING OF AFOSR CONTRACTORS AND GRANTEES PERFORMING RESEARCH ON PHYSICAL ENERGETICS: RESEARCH SUMMARIES
Magne Kristiansen and Marion O. Hagler, comps. 5 Apr. 1971 151 p refs Meeting held at Lubbock, Tex., 1-3 Jun. 1971
(Grant AF-AFOSR-1757-69)
(AD-727075; AFOSR-69-1757SR1; AFOSR-71-0714TR) Avail: NTIS CSCL 20/9

The report contains summaries of the research presentations made at round table discussions at the 14th Meeting of AFOSR Contractors and Grantees Performing Research on Physical Energetics at Texas Tech University, Lubbock, Texas on June 1-3, 1971. The purpose of this conference is to exchange the latest information on research in non-chemical energy sources, release mechanisms and conversion processes. Author (GRA)

N71-38499# Naval Research Lab., Washington, D.C.
COMPARISON OF NUMERICAL SOLUTIONS OF THE VLASOV EQUATION WITH PARTICLE SIMULATIONS OF COLLISIONLESS PLASMAS
Jaques Denavit and W. L. Kruer (Princeton Univ.) Jun. 1971 43 p refs Sponsored in part by AEC
(AD-727085; NRL-MR-2276) Avail: NTIS CSCL 12/1

This paper presents numerical solutions of the Vlasov and Poisson equations for several physically significant problems and compares these solutions with the results of particle simulations. The numerical solutions of the Vlasov equation are based on the Fourier-Fourier transform method. The spatial representation includes up to 85 modes and is capable of representing strong nonlinear effects. The particle simulations are based on a multipole expansion of finite-size particles about their nearest grid point location. Special techniques are used to suppress the noise and to accurately control the initial conditions of the plasmas so that quantitative comparisons with Vlasov solutions can be made. Close quantitative agreement between the results of the two simulation techniques is observed. The problems considered are one-dimensional, with periodic boundary conditions, and involve (1) two-stream instabilities, with equal and unequal electron beams, and (2) large-amplitude electron oscillations, with sideband instabilities. Author (GRA)

N71-38500# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
COUPLING OF MONOCHROMATIC WAVES IN AN ELASTOHYDRODYNAMIC MODEL
D. Zoler et al 16 Jun. 1971 15 p refs Transl. into ENGLISH from Bul. Inst. Politeh. Iasi (Iasi), v. 15, no. 1, 2, 1969 p 143-150
(AD-727932; FTD-HC-23-298-71) Avail: NTIS CSCL 20/9

The study of certain magnetohydrodynamic problems necessitates the construction of models that permit following the plasma phenomena more easily. Such a model is proposed. In a rectangular receptacle there is a liquid in which very thin rubber bands are arranged to give it elastic qualities. This provides the elastohydrodynamics to study this system. The way a disturbance is propagated in such a liquid models the transmission of the Alfven wave and of the slow and rapid elastohydrodynamic waves in a plasma. In this article, the authors propose to study the coupling of elastohydrodynamic waves. Author (GRA)

N71-38501# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
A STUDY OF THE FINE STRUCTURE OF A PLASMA FOCUS USING THE PERFORATED CAMERA OBSCURA METHOD
V. I. Agafonov et al 4 Jun. 1971 15 p refs Transl. into ENGLISH of the book "Issled. Tonkoi Struktury Plazmennogo Fokusa Metodom Mnogodyrochnykh Kamer-Obskur" Moscow, 1970 p 1-8
(AD-727873; FTD-HT-23-127-71) Avail: NTIS CSCL 20/9

The present work consists of developing an x-ray camera obscura method to study the final cumulation stage of a shell during noncylindrical compression of the Z-pinch. Selection of orifices from 4 to 44 micrometers and photography from two mutually perpendicular directions permitted the authors to determine the plasma-focus (PF) diameter more accurately, to detect the complex fine structure of the high-temperature zone connected with a value of the neutron yield and the intensity of the hard x-ray radiation, and to compare the experimental values of the PF dimensions with those determined. From the obtained experimental results the density of the charged particles in the given PF is estimated. Author (GRA)

N71-38502# Idaho Univ., Moscow.
NONISOTHERMAL MHD DUCT FLOW
William Joseph Thomson (Ph.D. Thesis) Mar. 1969 169 p refs Avail: NTIS

The partial differential equations describing the simultaneous transport of momentum, energy and magnetic field, are derived for fully developed MHD flow in finite ducts. The fluid properties are allowed to vary to the extent that electrical conductivity and viscosity are assumed to be temperature dependent. For heated

or cooled electrically insulating walls, numerical solutions are obtained by utilizing a modified Gauss-Siedel algorithm. It is shown that consideration of variable fluid properties results in friction factors and bulk flow rates which differ from constant property solutions by as much as a factor of two, and by fifty percent even for small variations. For ducts operated as electromagnetic flowmeters, variable fluid properties produce flowmeter sensitivities thirty percent above ideality for cooling at the walls, and up to sixty percent below ideality for heated walls. Analysis leads to the conclusion that it is the nature of the current distributions in the duct which is important in predicting the character of nonisothermal MHD duct flow. Author

N71-38503 Rochester Univ., N.Y.
AN EXPERIMENTAL STUDY OF A TRAVELING WAVE MAGNETIC FIELD PLASMA ACCELERATOR
Lowell Enrick Wilcox (Ph.D. Thesis) 1970 179 p
Avail: Univ. Microfilms Order No. 70-17915

An experimental study is made of accelerating a plasma with a traveling wave magnetic field. The accelerating channel is a diverging annulus between two non-conducting coaxial cones, the inner cone converging in the flow direction and the outer one diverging in the flow direction. Helical windings are placed outside the outer cone and inside the inner cone; silicon iron core material, laminated in an axial direction, is place inside the inner windings and outside the outer windings. Argon introduced between the two cones, is ionized by the traveling field and is then accelerated in an axial direction by the field. Thrust outputs of 0.05 newton have been obtained using argon as the propellant with a corresponding mass flow rate and efficiency of 4x0.001 gm/sec and 8% respectively. Measured conductivities indicate that, at most, 1% of the propellant is ionized.
Dissert. Abstr.

26 PHYSICS, SOLID-STATE

Includes semiconductor theory; and superconductivity. For applications see: 16 Masers. For related information see also: 10 Electronics.

N71-38504*# National Bureau of Standards, Washington, D.C. Electronic Technology Div.
METHODS OF MEASUREMENT FOR SEMICONDUCTOR MATERIALS, PROCESS CONTROL, AND DEVICES
Quarterly Report, 1 Jan. - 31 Mar. 1971
W. Murray Bullis, ed. Oct. 1971 54 p refs Sponsored in part by Air Force Weapons Lab., AEC, and Navy Electronics Systems Command
(NASA Order S-70003G; NASA Order H-76553A; DASA Order EA071; PO$_2$1-0030; PO-1-0041)
(NASA-CR-123167; NBS-TN-598) Avail: NTIS; SOD $0.55 CSCL 20L

Significant accomplishments include application of tuning and other related procedures for ultrasonic wire bonders in an industrial environment with a reported reduction of rejection rate at visual inspection by more than a factor of two, more complete evaluation of the photovoltaic method for determining radial resistivity profiles of circular semiconductor wafers, and identification of test conditions in which a dc calibration curve may properly be used in measurements of thermal resistance. Work was continued on measurement of resistivity, carrier lifetime, and electrical inhomogeneities in semiconductor crystals; specification of germanium for gamma-ray detectors; evaluation of wire bonds and die attachment; measurement of thermal properties of semiconductor devices, transit-time and related carrier transport properties in junction devices, and electrical properties of microwave devices; and characterization of silicon nuclear radiation detectors. Author

N71-38505# California Univ., Berkeley. Lawrence Radiation Lab.
VAPORIZATION KINETICS OF ZINC OXIDE SINGLE CRYSTALS
Robert J. Gelluzzo (Ph.D. Thesis) Apr. 1971 16 p refs
(Contract W-7405-eng-48)
(UCRL-20528) Avail: NTIS

The rates of vaporization of opposite basal faces of zinc oxide have been measured as functions of temperature. The average apparent enthalpies of vaporization for the reaction ZnO sub(s) yields Zn sub(g) + 1/2O2 sub(g) for the two faces were measured to be: zinc-rich (0001) face, 134.6 kcal/mole; oxygen-rich (000(-1)) face, 140.8 kcal/mole. The differences between these values is greater than probable experimental error in the measurements, and both enthalpies are larger than the enthalpy of the equilibrium reaction, 110.5 kcal/mole in the temperature range studied. The apparent entropies for the reaction were measured to be: (0001) face, 51.0 eu and (000(-1)) face, 50.3 eu. These entropies, to within expected limits of error, are equal to each other and to the entropy of the equilibrium reaction in the same temperature, 48.0 eu. Author

N71-38506# Princeton Univ., N.J. Dept. of Chemical Engineering.
[INTERFACIAL PHENOMENON, MOSSBAUER EXPERIMENTS, AND ATMOSPHERIC CHEMISTRY] Summary of Progress, 16 May 1970 - 15 May 1971
1971 7 p refs
(Contract AT(30-1)-2807)
(NYO-2807-91) Avail: NTIS

A mathematical model of the motion of small drops and bubbles was developed in which specific account is taken of adsorption, diffusion and convection of surface-active molecules in the interfacial region. Several situations were examined and new results obtained in cases where the diffusion rates are either much larger or much smaller than convection rates. Analytical expressions were developed which facilitate the interpretation of experimental data and which show many of the observed features viz., an asymmetrical toroidal circulation and a rapid transition between the free interfacial state and the immobile state. Author

N71-38507# Iowa State Univ. of Science and Technology, Ames.
ELECTRON TUNNELING MEASUREMENTS ON PURE BULK THORIUM
Brent Alan Haskell (Ph.D. Thesis) Jun. 1971 98 p refs
(Contract W-7405-eng-82)
(IS-T-436) Avail: NTIS

Electron tunneling measurements were performed on pure bulk thorium samples over the temperature range 0.3 to 1.4 K. The data for most of the tunnel junctions were corrected for the presence of an unexplained parallel conductance mechanism. An apparent correlation exists between the electron tunneling results and the crystalline structure of the thorium in the junction region. Thorium samples of a given type of crystallinity display very similar (di/dv) sub (v=0) vs reduced temperature curves. The actual di/dv vs v curves for these samples are also very similar, although discrepancies are pent for bias voltages corresponding to energies greater than half the value of the energy gap. Entire differential conductance curves were calculated, assuming a BCS density of states for junctions typical of each type of crystalline structure. The results are discussed in terms of existing theories of two-energy band metals and in terms of previous experimental data for thorium. Author (NSA)

N71-38508# Oak Ridge National Lab., Tenn.
LATTICE DYNAMICS OF RUTILE
Joseph Gibson Traylor (Ph.D. Thesis - Tenn. Univ., Knoxville) Dec. 1970 196 p refs Sponsored by AEC
(TID-25720) Avail: NTIS

The lattice dynamics of rutile has been investigated experimentally and theoretically. Phonon dispersion relations have been measured by the coherent inelastic scattering of

thermal neutron along the principal symmetry directions and at the high symmetry points of the Brillouin zone. The phonon frequencies at zero wavevector are in good agreement with the published measurements of the Raman-active modes, and are in reasonable agreement with the published measurements of the infrared-active modes. The slopes of all of the measured acoustic branches are in good agreement with the slopes predicted by the elastic constants. Theoretical models were constructed based on second-neighbor short-range forces and long-range Coulomb forces. These models were fitted to the measured dispersion curves by nonlinear least squares techniques, with the interatomic force parameters treated as variables. Author (NSA)

N71-38509# California Univ., Irvine. Dept. of Physics.
THEORETICAL STUDY OF SOME DYNAMICAL PROPERTIES OF PERFECT AND IMPERFECT CRYSTALS Final Report
Alawi A. Maradudin May 1971 11 p refs
(Grant AF-AFOSR-1448-68)
(AD-727327; AFOSR-71-1907TR) Avail: NTIS CSCL 20/12

The work performed has been in the areas of the optical and surface properties of perfect and imperfect crystals. It has resulted in theories of Raman and Brillouin scattering of light, and infrared absorption, by phonons in metal surfaces; it has yielded first principles calculations of the microscopic crystal tensors governing these effects; it has led to the discovery of new mechanisms for light scattering by elementary excitations in insulators, semiconductors, metals and superconductors; it produced the first calculations of surface vibration modes for ionic crystals and a theory of the damping of surface modes; and led to the solution of several lattice dynamical defect problems. Author (GRA)

N71-38510# Office of Naval Research, Arlington, Va.
SUPERCONDUCTING TECHNOLOGY IN JAPAN
Richard G. Brandt Jun. 1971 17 p
(AD-727084; ONR-28) Avail: NTIS CSCL 20/12

Superconducting technology in Japan is in an advanced state and merits continuing attention by outside observers. The university research effort is strong but not unique, with a few exceptions. The real strength is in the industrial effort whose impetus is supplied by the national projects. In the absence of these national projects, there is not enough demand to sustain the many companies involved. High-energy experimental physics and related research efforts are relatively deemphasized in Japan, and thus do not create the same demand for superconducting magnets that exists in our country and in Europe. However, the two national projects--for MHD power generation and the planned project for train levitation--are in the forefront of advancing technology, not duplicated in magnitude by efforts elsewhere. These and other attempts to develop large-scale applications are the most significant aspect of superconducting technology in Japan. Contrasted with these pioneering efforts, research and development on Josephson effect devices lags behind work in progress in other countries. Author (GRA)

N71-38511# Autonetics, Anaheim, Calif.
EPITAXIAL FILM GROWTH OF BUBBLE DOMAIN MATERIALS Semiannual Report, 1 Nov. 1970 - 30 Apr. 1971
D. M. Heinz, P. J. Besser, P. E. Elkins, H. L. Glass, and J. E. Mee Jun. 1971 39 p refs
(Contract F33615-71-C-1058)
(AD-727070; C70-1431.6/501; AFML-TR-71-126) Avail: NTIS CSCL 20/2

The program's objective is to improve the compatibility between substrates and films of epitaxially grown magnetic bubble domain materials. The initial effort has been concerned with gallium-substituted erbium iron garnet films prepared by chemical vapor deposition. The introductory section of this report contains a discussion of the means by which the requirements for the existence of cylindrical magnetic domains may be met in epitaxial films. The experimental section deals with substrate crystal growth, chemical vapor deposition of magnetic garnet films and film characterization. Detailed accounts are presented on substrate lattice parameters and techniques for characterizing magnetic bubble domain films. Author (GRA)

N71-38512# Uppsala Univ. (Sweden). Inst. of Physics.
BAND STRUCTURE INVESTIGATIONS BY ULTRASONIC SUSCEPTIBILITY, AND GALVANOMAGNETIC MEASUREMENTS Final Scientific Report, 1 Jun. 1966 - 31 Dec. 1970
Olof Beckman 28 Jun. 1971 10 p refs
(Contract AF 61(052)-937)
(AD-727069; AFOSR-71-2047TR) Avail: NTIS CSCL 20/12

The elastic constants, the dielectric constant and the thermal expansion of alkali halides have been investigated. Theoretical calculations have been made of cohesive energy, lattice constants and elastic constants on a strictly quantum mechanical basis. The Fermi surface of antimony has been studied by magnetoacoustic resonance at arbitrary angles between the sound wave and the magnetic field. Acoustic cyclotron resonance has been observed, giving data on the non-ellipsoidal Fermi surface. The de Haas-van Alphen effect has been used for the study of the degenerate semi-conductor, Sb2Te3, and the metal, Ir. The spin structure of phosphides and germanides of 3d-elements has been studied by susceptibility, magnetization, conductivity and specific heat measurements. The three polymorphs of FeGe have been studied most extensively. Other materials studied are Fe3P, Fe2P, FeP2, etc. Author (GRA)

N71-38513# Harvard Univ., Cambridge, Mass.
ELECTRICAL AND OPTICAL PROPERTIES OF HIGH QUALITY CRYSTALLINE V2O4 NEAR THE SEMICONDUCTOR METAL TRANSITION TEMPERATURE
Larry A. Ladd Jun. 1971 213 p refs
(Contracts N00014-67-A-0298-0012; ARPA SD-88)
(AD-727242; HP-26; ARPA-TR-41) Avail: NTIS CSCL 20/12

The object of this research is to contribute to our knowledge and understanding of the electrical and optical properties of high quality crystalline V2O4. This material exhibits a phase change at 68 C which is accompanied by a change in electrical resistivity of five orders of magnitude which is often referred to as a semiconductor-metal transition. Several theories had been suggested to explain the nature of this transition, but sufficient experimental evidence to determine which, if any, of these theories applied to V2O4 was not available at the time this research began. In particular, it was not known whether or not V2O4 was a Mott insulator below the transition temperature, or whether a band theory approach such as the Adler-Brooks theory might describe the transition. This research has resulted in experimental measurements and theoretical analysis which permit a tentative explanation of the transition mechanism to be made. Author (GRA)

N71-38514# Hughes Research Labs., Malibu, Calif.
SELECTIVE DOPING OF PIEZOELECTRIC CRYSTALS BY ION IMPLANTATION Final Report
O. J. Marsh, W. R. Jones, M. Waldner, M. T. Wauk, R. R. Hart et al May 1971 110 p refs
(Contract N00014-68-C-0171)
(AD-727067) Avail: NTIS CSCL 20/12

The feasibility of creating n-type conducting regions in semi-insulating (~ 10 to the 7th power cm) piezoelectric crystals by ion implantation has been investigated. The ultimate purpose would be to form monolithic acoustic surface-wave amplifiers. Experimental studies have been performed with ZnO, CdS, and GaAs. Cadmium sulfide was implanted with B, Al, Ga, Fl, and Cl. Sulfur implantations into GaAs produced n-type layers with mobilities of 2000 sq cm/V-sec. Studies of implantation doping with protons into ZnO showed that layers of controlled sheet resistivities could not be predicted but could be produced. Adsorption and desorption of oxygen during and after implantation played a significant role in determining the conductivity of the

implanted layer, suggesting that considerable difficulty with stability in the final device might be expected. Carrier mobilities in the proton implanted layers as high as 71 sq cm/V-sec were observed, which is sufficient for amplifier action. The monolithic amplifier device has been analyzed theoretically, treating separately the propagating characteristics of surface waves and the amplifying section utilizing a thin doped conducting region. Calculations on the performance of the amplifying element have been made in two ways. First, an analytical expression is derived in a simple way on the assumption that the conducting region is very thin. Second, an exact computer program was developed to describe the operation of a very general amplifying structure.
Author (GRA)

N71-38515# Arizona State Univ., Tempe.
AN EXPERIMENTAL STUDY OF DEFECT ORDERING AND TRANSPORT PHENOMENA IN NONSTOICHIOMETRIC METAL OXIDES Final Report, 1 Apr. 1968 - 30 Jun. 1970
Clement J. Kevane 30 Apr. 1970 28 p refs
(Contract N00014-68-A-0308-0001)
(AD-727100) Avail: NTIS CSCL 20/12

The purpose of the work reported here was to determine the effects of defect ordering on transport phenomena in nonstoichiometric metal oxides. The work consisted of: a study of electric charge transport in reduced titanium oxide over a wide range of temperature, a study of the conditions for achieving known reduced nonstoichiometric compositions while maintaining unbroken crystal samples, and monitoring specimens by X-ray diffraction to look for evidence of defect clustering or superlattice formation.
Author (GRA)

N71-38516# Vanderbilt Univ., Nashville, Tenn. School of Engineering.
STRUCTURAL EFFECTS ON ELECTRICAL PROPERTIES IN AMORPHOUS SEMICONDUCTORS Semiannual Technical Report, 1 Jan. - 30 Jun. 1971
D. L. Kinser and L. K. Wilson 31 Jul. 1971 87 p refs
(Contract DAHC04-70-C-0046; ARPA Order 1562)
(AD-727154; SATR-2) Avail: NTIS CSCL 20/12

Work has been concentrated on a survey of the structure, electrical and magnetic properties of transition metal oxide-phosphate glasses and glasses in the As2Te3-As2Se3 system which possess electrical or magnetic device potential. Results of magnetic and electrical observations in several transition metal-phosphate glasses have revealed a high degree of magnetic and structural order. The pronounced influence of glass-glass phase separation has also been noted. Examination of a V2O5 - P2O5 glass has revealed an antiferromagnetic transition in the glass at a low temperature. Results on a CuO-P2O5 glass are promising, in that an extremely large range of conductivities has been observed thus indicating potentially useful in device application. Detailed studies of the As2Te3-As2Se3 system has shown switching behavior which can be controlled with compositional variation.
Author (GRA)

N71-38517# Stanford Univ., Calif. Center for Materials Research.
RESEARCH ON AMORPHOUS MATERIALS Annual Report, 1 Jun. 1970 - 31 May 1971
W. E. Spicer, A. Bienenstock, and R. H. Bube 31 May 1971 95 p refs
(Contract DAHC04-70-C-0044; ARPA Order 1562)
(AD-727179; SU-CMR-71-11; AR-1) Avail: NTIS CSCL 20/12

The report describes efforts to study some of the relationships among structure, bonding, electronic structure and transport properties of various amorphous semiconductors.
Author (GRA)

N71-38518# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
REDUCING THE RADIATION CONDUCTIVITY OF GERMANIUM AS A RESULT OF IONIC BOMBARDMENT AND THE POSSIBILITY OF ITS PRACTICAL UTILIZATION
I. A. Abroyan et al 21 Jun. 1971 10 p refs Transl. into ENGLISH from Tr. Leningr. Politekn. Inst. (Moscow), 1967 p 121-123
(AD-727863; FTD-MT-24-40-71) Avail: NTIS CSCL 20/12

The radiation-caused conductance in Ge occurs when the Ge surface is bombarded by fast or slow (a few hundred ev) ions. If the bombardment is continued, the additional conductance falls off. Thus, a Ge crystal with an additional conductance caused by a 100-10,000 ev ion bombardment exhibits an abrupt reduction of its conductance on subsequent bombardment by protons, given molecular ions, He-, Li-, Na-, or Cs-ions. The reduction of the radiation conductance of Ge induced by given ions at 5 kev and at 2 kev is illustrated in a figure where the ratio of additional-conductance given current to primary ion current I is plotted against the number of ions hitting 1 sq. cm of specimen surface. The above phenomenon can be used for measuring ion- or neutral-particle-beam cross-section, density distribution, etc.; also, it can be employed for recording ions and atoms bombarding walls and electrodes, of electron and ion devices and the like.
Author (GRA)

N71-38519# Istituto Superiore di Sanita, Rome (Italy). Lab. di Fisica.
TEMPERATURE MODULATION OF THE OPTICAL CONSTANTS OF LAYER COMPOUNDS GaSe AND GaS
M. Grandolfo, F. Somma, and P. Vecchia 28 May 1971 35 p refs
(ISS-71/9) Avail: NTIS

The thermoreflectance spectra of the layer compounds GaSe and GaS is reported at liquid nitrogen temperature in the energy interval 2 to 6 eV. The spectra were subjected to a Kramers-Kronig analysis, and the changes in the real and imaginary parts of the dielectric constant, induced by the temperature change of the samples, were obtained. The optical constants of the two materials were computed by processing the known reflectivity spectra. A phenomenological interpretation of the observed experimental results is presented. It is shown that under certain conditions it is necessary to invoke the presence of excitons at saddle-point singularities in order to achieve reasonable agreement between theory and experiment.
Author

N71-38520# Aerospace Corp., El Segundo, Calif. Lab. Operations.
PHOTOFABRICATION OF THIN FILMS AND THIN FILM STENCILS Technical Report, May - Jun. 1967
Eric L. Fletcher 1 Jul. 1971 26 p refs
(Contract F04701-71-C-0172)
(AD-727758; TR-0172(9230-20)-3; SAMSO-TR-71-159) Avail: NTIS CSCL 13/8

One of the purposes of this report is to provide a clear description of the principles of photofabrication as they apply to the accomplishment of precise, thin film configurations. In this regard, photofabrication techniques are used both to make the metal sheet stencils which define thin film patterns during deposition and to alter the pattern after deposition. In addition, equipment is described which was designed and built for specialized thin film and semiconductor investigations in the Electronic Research Laboratory. The equipment described will accommodate a one inch square resist pattern on a flat surface. Holding fixtures have been made for one inch square glass substrates and three inch square stainless steel shimstock. A considerable amount of commercial equipment is available but it is expensive and would be considerably more so if modified for our requirements. The step-by-step operating procedure is discussed in sufficient detail to facilitate the use of the equipment by a person initially unfamiliar with the processes.
Author (GRA)

N71-38521*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
EVALUATION OF STRUCTURAL DEFECTS IN CRYSTALS: A PREREQUISITE TO CRYSTAL GROWTH IN SPACE
V. K. Jain and J. C. Horton Washington Oct. 1971 29 p refs

(NASA-TN-D-6505; M365) Avail: NTIS CSCL 20B

The task of evaluating the crystals to be grown in space is considered. A need for realizing the relevance of the line defects (such as dislocations and stacking faults), complexes of these and point defects, and impurity segregates is stressed. Techniques for observing these defects are discussed in regard to their applicabilities to the precious space-grown crystals. Etching techniques are partially destructive, but of multiple utility. Their application to gallium arsenide epitaxial layers grown on earth is demonstrated by the experiments done in the laboratory. Precise experimental procedures are given. Author

N71-38522 Stanford Univ., Calif.
PHOTOELECTRONIC PROPERTIES OF TRAPS IN CdS AND CdS-CdSe CRYSTALS
Ho Bin Im (Ph.D. Thesis) 1970 124 p
Avail: Univ. Microfilms Order No. 70-18419

Trapping centers with the desired properties were found in crystals of CdS, subjected to previous electron radiation damage and photoexcited annealing, and in crystals of CdS-CdSe, annealed in S-Se vapor to produce high resistivity after growth. Photoexcitation between 77 and 350 K decreases the intensity of the thermally stimulated conductivity (TSC) peak at 240 K, and photoexcitation between 170 and 300 K increases the intensity of the peaks near room temperature. Both processes are dependent on the temperature and wavelength of photoexcitation used. Photochemical reactions are involved in the observed processes and possible models are suggested. Evidence for the participation of hole traps in TSC and photoconductivity decay is obtained through measurements of Hall and thermoelectric effects. Dissert. Abstr.

N71-38523 North Carolina State Univ., Raleigh.
COMPUTER TECHNIQUES FOR ACCURATE SOLID STATE DEVICE ANALYSIS
Edward Demah Graham, Jr. (Ph.D. Thesis) 1970 222 p
Avail: Univ. Microfilms Order No. 70-18969

Semiconductor device operation can be characterized by a coupled set of nonlinear partial differential equations. These nonlinear equations are formulated in terms of the electrostatic potential, and the hole and electron quasi-Fermi levels. The quasilinearization or Newton-Raphson method is used in an iterative fashion to obtain exact solutions to the device equations. The quasilinearization technique linearizes the nonlinear portions of the equations through a Taylor series expansion in function space about the functions and their derivatives. By approximating the partial derivatives with finite difference expressions, the semiconductor device problem is reduced to the solution of coupled, linear, difference equations. Integral expressions for the current densities in terms of the three independent variable arrays are developed such that current density distributions and carrier distributions across a given device as well as J-V characteristics can be obtained. Provisions for analysis of transient effects are also included. Dissert. Abstr.

N71-38524 Stanford Univ., Calif.
COMPUTER AIDED ANALYSIS OF INSULATED GATE FIELD-EFFECT TRANSISTORS
Mark Brown Barron (Ph.D. Thesis) 1970 200 p
Avail: Univ. Microfilms Order No. 70-18375

The classical analysis of insulated gate field-effect transistors (IGFET) is reviewed and the corresponding theory is compared with experimental characteristics. The limitations of this theory are indicated and the reasons for the limitations are explained in terms of the device physics. Two operating configurations which do not comply with the classical theory are subsequently analyzed with the aid of a digital computer; these are low-level current operation for gate voltages near threshold, and punch-through operation for short devices. The numerical data obtained from the low-level analysis is compared with experimental V-I characteristics, and it is shown that the device can be accurately modeled using the classical surface physics equations. Algebraic approximations, which offer certain advantages over numerical analysis, are shown to adequately describe transistor operation over certain current ranges. Derivations of the finite difference equations for numerical iterative analysis of the IGFET are described in detail. Certain stability problems are found to occur and methods for avoiding these are presented. Dissert. Abstr.

N71-38525 Stanford Univ., Calif.
DESIGN, FABRICATION, AND EVALUATION OF A SILICON JUNCTION FIELD-EFFECT PHOTODETECTOR
Steve Gary Bandy (Ph.D. Thesis) 1970 101 p
Avail: Univ. Microfilms Order No. 70-18374

A new device for photodetection is introduced in this study which is capable of responsivities comparable to devices operating in the charge-storage mode. Since the physical process involved corresponds to a photodiode in series with a high value of resistance, the device operates in real time and hence avoids the problems of switching encountered in the charge-storage mode at low light levels. The device utilizes this physical process in new technique which significantly reduces the required surface area. In contrast to the area independent responsivity of the charge-storage mode, it is shown that the responsivity of the field effect photodetector is proportional to the square of the device surface area. Depending upon the illumination level and the deviation from linearity that is tolerable, this area dependance presents one of the fundamental drawbacks of the field effect photodetector for application in dense arrays. Dissert. Abstr.

27 PROPELLANTS

Includes fuels; igniters; and oxidizers. For basic research see: 06 Chemistry; and 33 Thermodynamics and Combustion. For related information see also: 28 Propulsion Systems.

N71-38526*# Bell Aerospace Co., Buffalo, N.Y.
EVALUATION OF METALLIC POSITIVE EXPULSION BELLOWS OPERATING PARAMETERS WITH CRYOGENIC PROPELLANTS Final Report
R. L. Lange and Hughes. J. T. 26 Jul. 1971 43 p refs
(Contract NAS3-13327)
(NASA-CR-72979) Avail: NTIS CSCL 21I

Work performed to determine any change in the ability of metallic positive expulsion bellows to resist the damage mechanisms of vibration, fatigue, storage and buckling while containing liquid hydrogen or liquid oxygen described. The results of the test program were compared to the results of a previously conducted similar test program at ambient temperature. The results have shown that metallic bellows are suitable for positive expulsion of liquid hydrogen and liquid oxygen. The data obtained has been used to correct analytical techniques for predicting wear, cycle life, buckling pitch and strain distribution patterns. Author

N71-38527*# Aireserch Mfg. Co., Los Angeles, Calif.
EXTERNAL PRESSURIZATION SYSTEMS FOR CRYOGENIC STORAGE SYSTEMS Final Report
P. G. Wapato 10 Sep. 1971 211 p refs
(Contract NAS8-10453)
(NASA-CR-116206; Rept-71-7537) Avail: NTIS CSCL 21I

Recirculation-type external pressurization systems were investigated for use in pressure control of cryogenic hydrogen, oxygen and nitrogen storage systems. A conceptual alternative to internal heating devices or injection of gaseous pressurants as a means of tank pressurization during delivery of fluid is presented. Author

N71-38528*# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ANTIOXIDANT FCh-16

A. G. Zilberman 23 Apr. 1971 7 p Transl. into ENGLISH from Neftepererabotka Neftekhimiya (USSR), no. 2, 1970 p 1-2
(AD-727438; FTD-HT-23-168-71) Avail: NTIS CSCL 21/4

Extractive phenols from cheremkhovo coals, vacuum distilled to remove the heavy residue, gave an additive for motor fuels. FCH-16 antioxidant has a higher efficiency than other additives, inhibiting the formation of gum and residues in motor gasoline, tractor, reactive, and diesel fuels, containing components of thermal or catalytic cracking. Author (GRA)

N71-38529# Stevens Inst. of Tech., Hoboken, N.J. Dept. of Mechanical Engineering.
AN INVESTIGATION OF THE COMBUSTION CHARACTERISTICS OF SOME POLYMERS USING THE DIFFUSION FLAME TECHNIQUE
William S. Blazowski (Ph.D. Thesis), Richard B. Cole (Ph.D. Thesis), and Robert F. McAlevy (Ph.D. Thesis) Jun. 1971 196 p refs
(Contract N00014-67-A-0202-00023)
(AD-727990; ME-RT-71004) Avail: NTIS CSCL 21/9

A means for producing combustion of polymers under well-controlled conditions has been employed for study of their fundamental combustion characteristics. In the subject work, a planar diffusion flame is established between an axi-symmetric, 'stagnation-point' flow of gaseous oxidant and the pyrolysis product vapors emerging from the polymer surface lying below. Surface regression rate, surface temperature, and oxidant mass flow rate (the principal control variable) were determined. Plexiglas, Plexiglas-55, polyethylene, polypropylene, Delrin, nylon 6-6, ICRPG polyurethane binder, and polystyrene were tested. Surface regression rate and surface temperature were correlated by means of an Arrhenius function, and these results are utilized to examine previously proposed models of the surface pyrolysis process. The surface regression rate and oxidant mass flow rate were used with a fluid-dynamic analysis of the combustion region to predict the effective heat of gasification for each of the above mentioned polymers. Applications and implications of the above findings are discussed. Author (GRA)

N71-38530# Dynamic Science, Irvine, Calif.
SUPERSONIC COMBUSTION CHEMISTRY AND MIXING OF HIGH ENERGY DENSITY FUELS RELATED TO ADVANCED AIR-BREATHING ENGINE DESIGN Final Report
Stuart Hersh 30 Apr. 1971 45 p refs
(Contract F44620-70-C-0061)
(AD-727782; SN-209) Avail: NTIS CSCL 21/2

The program is directed towards answering the following question. Given a boron combustible particle of known initial size and composition moving at a high relative velocity in a gaseous medium, how are the combustion behavior and particle dynamics influenced by the particle/gas relative velocity, gas composition, temperature, and pressure anticipated in operational combustors? The role of the shock tube in answering this question is discussed. An 'ideal' experiment is postulated and several possible practical experimental techniques are assessed relative to this standard. To aid in the assessment of the practicality of an experimental technique, a computer program was developed to compute particle trajectories for shock tube flows. Some preliminary experiments aimed at establishing the applicability of a reflected shock technique to the measurement of burning particle drag coefficients were carried out. The results of these experiments yielded very high values of the drag coefficient. At the present time, it is not known if this result was due to the roughness of the particles, static charge effects, the effect of combustion or the preliminary nature of the experiments. In all probability a combination of the above factors is involved. Author (GRA)

N71-38531# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
AVIATION FUELS, LUBRICANTS AND SPECIAL LIQUIDS
A. F. Alsenov 14 May 1971 367 p refs Transl. into ENGLISH of the book "Aviatsionnye Topliva, Smazochnye Materialy i Spetsialnye Zhidkosti" Moscow, Izd-vo Transport, 1970 p 1-255
(AD-727199; FTD-MT-24-07-71) Avail: NTIS CSCL 21/4

The report presents the methods of obtaining, the chemical composition of the operational properties, and the methods of controlling the applicable fuels, lubricants, and special liquids. Main attention is paid to the heat of combustion of fuels; to the stability of fuels, oils, of lubricants, and liquids under various operating conditions; to the pumpability of fuels and oils, the corrosion, antiwear, and antiseizing properties. Attention is also paid to fuels for supersonic aviation, promising lubricating materials, including solid lubricants, and promising liquids. The book is intended as a textbook for students of aviation higher educational institutions. Author (GRA)

N71-38532# Hughes Aircraft Co., El Segundo, Calif.
NONUNIFORM PROPELLANT DISTRIBUTION IN MULTIPLE TANK ROCKET FEED SYSTEMS
Gilbert F. Pasley Aug. 1971 29 p refs Backup document for AIAA Synoptic scheduled for publication in Journal of Spacecraft and Rockets on Feb. 1972
Avail: NTIS CSCL 21I

The various causes of propellant unbalance between tanks are surveyed, and approximations of the governing differential equations are used to arrive at the maximum values of propellant unbalance caused by temperature differences, acceleration fields, and geometric variations. The temperature difference is found to be the greatest cause of unbalance, with geometric variations and acceleration field following, in that order. The effect of bladders on unbalance is briefly discussed, and techniques which may be utilized to minimize the various effects are also suggested. Author

28 PROPULSION SYSTEMS

Includes air breathing, electric, liquid, solid, and magnetohydrodynamic propulsion. For nuclear propulsion see: 22 Nuclear Engineering. For basic research see: 23 Physics, General; and 33 Thermodynamics and Combustion. For applications see: 31 Space Vehicles. For related information see also: 27 Propellants.

N71-38533*# General Electric Co., Philadelphia, Pa.
THERMIONIC SPACECRAFT DESIGN STUDY, 120 KW NUCLEAR ELECTRIC PROPULSION SYSTEM. VOLUME 2: EXTERNAL FUEL REACTOR SPACECRAFT DESIGN Final Report
30 Jun. 1971 101 p refs Prepared for JPL
(Contracts NAS7-100; JPL-952381)
(NASA-CR-122927; GESP-648-Vol-2) Avail: NTIS CSCL 21C

Electrically propelled spacecraft designs for a Comet Halley Rendezvous mission, using thermionic reactors as the electrical power source were investigated. Four spacecraft designs were prepared. The four spacecraft designs include two external-fuel reactor concepts (heat pipe cooled diode and independently pumped diode) providing 120 kWe at 40 VDC to the thrust subsystem and two internal-fuel reactor concepts (10 VDC and 40 VDC) providing 120 kWe to the thrust subsystem. The impact of integration with the Space Shuttle, the use of U-233 fueled reactors, alternate EM pumps and main radiator systems is assessed for each of the four spacecraft designs. The three 40 VDC spacecraft designs are nearly the same size (1.14 m diameter by 20 m to 22 m long) with specific weights from 28 to 30 kg/kWe. The 10 VDC spacecraft design is 27 m long, with a specific weight of about 33 kg/kWe. Integration into the Space Shuttle adds 2 kg/kWe to the 40 VDC spacecraft designs, and 6 kg/kWe to the 10 VDC spacecraft. The use of U-233 fueled reactors reduces the specific weight by 5 kg/kWe for a spacecraft design except the 10 VDC internal-fuel concept. Author

N71-38534*# Marquardt Corp., Van Nuys, Calif.
SPACE STORABLE THRUSTER INVESTIGATION Final Report
J. G. Campbell Oct. 1971 98 p refs
(Contract NAS3-12058)
(NASA-CR-72865; S-994) Avail: NTIS CSCL 21H

A program of design, analysis and test firing was conducted to study the feasibility of using a radiation and film cooled 25 pound thrust graphitic thrust chamber with the liquid cryogenic propellants FLOX/propane and FLOX/ methane. Liquid propane and methane were used as film coolants in the first series of test firings. Carbon deposition on the injector and chamber walls prevented attainment of long run durations over 2 minutes. Less deposition occurred from liquid methane than from liquid propane. Gaseous methane was used for film cooling in the final series of test firings. Carbon deposition was less severe using gaseous methane cooling than that experienced using liquid methane, but firing duration of a graphite chamber was again limited to 2 minutes because of carbon buildup and erosion of the throat. Data are presented on injector performance, film cooling effectiveness and carbon deposition. Author

N71-38535*# Scientific Translation Service, Santa Barbara, Calif.
REMARKS ON THE PAPER OF M. D. C. WHITTLEY (PAPER NO. 13): SOME ASPECTS OF PROPULSION FOR THE AUGMENTOR WING CONCEPT [SUITE A LA COMMUNICATION DE M. D. C. WHITTLEY (PAPER NO. 13)]
M. H. Schmitt Washington NASA Oct. 1971 10 p Transl. into ENGLISH from Paper Presented at 38th Meeting of AGARD Propulsion and Energetics Panel, Inlet and Nozzles for Aerospace Engines, Sep. 1971 p 1-8
(Contract NASW-2035)
(NASA-TT-F-14005) Avail: NTIS CSCL 21E

A summary of the work in Europe on dilution systems is given which falls into the category of the propulsive wing. The first application was the aircraft ARADO 232 in Germany in 1943. After that, the ONERA in France took on the development of a combined suction and blowing system, beginning with its inception in 1945. Finally, the BERTIN Society in 1959 proposed the false wing system. New techniques of dilution, which have become available, seem to indicate that considerable improvements can be made. Author

N71-38536# Aeronautical Research Labs., Melbourne (Australia).
THERMODYNAMIC ANALYSIS OF THE CYCLE OF A PULSE CHARGED TURBO SUPERCHARGED TWO STROKE MARINE DIESEL ENGINE
J. E. Williams Jul. 1970 64 p refs
(ARL/ME-128) Avail: NTIS

As part of an investigation into the deterioration of performance of a turbo-supercharged two-stroke marine diesel engine, a thermodynamic analysis of the engine was made using a simplified model of the cycle. This satisfactorily correlated known characteristics of the engine, and enabled the determination of the relative importance of various factors contributing to the deterioration of performance. It also enabled calculation of the sensitivity of the engine to external or internal changes to the cycle, thus enabling assessment of various boosting schemes. Author

N71-38537# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE FUEL IS AIR
28 Jan. 1971 7 p Transl. into ENGLISH from Pravda (Moscow), no. 233, 1970 p 1
(AD-727496; FTD-HT-23-5-71) Avail: NTIS CSCL 21/3

Professor G. L. Grodzovskiy comments on Soviet achievements in developing plasma-ion engines capable of utilizing atmospheric gases to form an ion jet for propulsion. Development of an operational prototype is claimed. GRA

N71-38538# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DESIGN AND OPERATION OF AIRCRAFT GAS TURBINE ENGINES
N. A. Sherlygin et al 27 May 1971 484 p refs Transl. into ENGLISH of the book "Konstruktsiya i Ekspluatatsiya Aviatsionnykh Gazoturbinnykh Dvigateley" Moscow, 1969 p 1-371
(AD-727188; FTD-HC-23-519-70) Avail: NTIS HC $6.00/MF $0.95 CSCL 21/5

The textbook presents an analysis of the designs of modern gas turbine engines. It discusses forces acting on the essential units, and their dependence on the operating regimes of the engine and the flight conditions. The construction and the operation of the engine components and parts are described. Methods of calculating safety factors for the most heavily loaded parts are given. Problems of vibration and methods of computing the vibrational load factors for engines are discussed. The operation and construction of the lubrication, fuel supply, start-up, and automatic engine control systems are examined. Brief data are given on the servicing of the engines when in operation. Author (GRA)

N71-38539# Curtiss-Wright Corp., Wood-Ridge, N.J.
SMALL AXIAL TURBINE STAGE COOLING INVESTIGATION Final Report
A. Stappenbeck, S. Moskowitz, T. Dalton, H. Watts, and A. Sievers Apr. 1971 195 p refs
(Contract DAAJ02-69-C-0064)
(AD-727741; CW-WR-69-077.F; USAAVLABS-TR-71-14) Avail: NTIS CSCL 21/5

The report describes an investigation of advanced cooling concepts for the gas producer axial flow turbine of a small gas turbine engine. These concepts were directed toward minimizing the engine performance penalties, especially at part power, associated with conventional air cooling of the turbine. The initial phase consisted of a conceptual analysis of five stator and five rotor cooling concepts. The coolants for closed systems included liquid metal, high pressure gas, two phase H_2O, heat pipe (two-phase liquid metal), and superheated steam. Modulated compressor air for transpiration cooling was also studied. To return the heat to the cycle, heat exchangers used in conjunction with the closed coolant systems utilized compressor exit air of fuels. Heat transfer analyses and preliminary designs were conducted on two selected turbine cooling concepts. The concepts selected as the most feasible included the closed systems using liquid metal or high pressure air for the stator and liquid metal or superheated steam for the rotor. Compressor discharge air was used as the heat sink for these systems. The effects of these systems on engine performance were also evaluated. Author (GRA)

N71-38540# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
NONSTEADY OPERATING REGIMES OF LIQUID ROCKET ENGINES
E. K. Moshkin 19 Apr. 1971 484 p refs Transl. into ENGLISH from the monograph "Nestatsionarnye Reshimy Raboty ZhRD" Moscow, Izd-vo Mashgiz., 1970 p 1-336
(AD-727988; FTD-MT-24-01-71) Avail: NTIS CSCL 21/5

In the book are examined the operation of liquid-propellant rocket engines under nonstationary conditions and transient conditions, dynamic processes and some questions of statics. There are considered differential equations, which characterize the operation of separate units and the engine on the whole during launching, at midcourse and during shutdown. There are discussed fundamentals of the theory of injectors, some questions of carburetion and burning; there is offered derivation of the formula for determination of combustion delay. The connection is established between this delay and the physical properties of the propellant components. The operation of basic units of the feed system is described, is given derivation of the universal equation of the tank pressurizing system and equations which characterize intratank processes are given. There are offered a

clear graphic-analytical method and methods of calculations of an engine with the aid of differential equations and with the use of computer technology. The materials discussed in the book can be used during thorough research and calculation of a liquid-propellant rocket engine and its units. Author (GRA)

N71-38541# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
GAS TURBINE ENGINES FOR HELICOPTERS
M. M. Maslennikov et al 24 Jun. 1971 488 p refs Transl. into ENGLISH of the publ. "Gazoturbinnyye Dvigateli dlya Vertoletov" Moscow, Mashinostr., 1969 p 1-380
(AD-727959; FTD-MT-24-141-70) Avail: NTIS HC $6.00/MF $0.95 CSCL 21/5

The first part, basically, elucidates questions connected with the use of gas turbine engines with a free power turbine for helicopters: the characteristics of thermal calculation and the calculation of characteristics, conditions of synchronizing the operation of the engine and the rotor, the means of adjustment, and the design. Briefly, mainly for purposes of comparison with engines with a free turbine, single shaft engines are also considered. The operating conditions of gas turbine engines on helicopters in service are elucidated. In the second part, questions are considered regarding the use of a jet drive of the rotor of a helicopter both by means of turbojet engines mounted on the blade tips and also by means of turbojet engines mounted on the blade tips and also by means of supplying compressed gas to jet nozzles on the blade tips. This book is intended for technical engineering workers who are engaged in designing and operation of helicopters and helicopter engines. It may also be useful for teachers and students of the respective specialities in aviation technical schools. Author (GRA)

N71-38542# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
COMBUSTION CHAMBERS OF GAS TURBINE ENGINES
Yu. M. Pchelkin 6 May 1971 274 p refs Transl. into ENGLISH of the publ. "Kamery Sgoraniya Gazoturbinnykh Dvigateley" Moscow, Mashinostro, 1967 p 1-207
(AD-727960; FTD-MT-24-306-70) Avail: NTIS CSCL 21/2

The report is a textbook for students studying power-engineering and machine building and it may also be useful to technical and engineering personnel and to advanced aeronautical engineering students. The book deals with gas-turbine fuels, fuel production, processing properties, and characteristics, combustion, combustion theory and products, combustion-chamber design, construction, and operation. GRA

N71-38543# Avco Corp., Wilmington, Mass.
PERFORMANCE OF QUASI-STADY MPD THRUSTERS AT HIGH POWERS
A. C. Malliaris, R. R. John, R. L. Garrison, and D. R. Libby Apr. 1971 48 p refs Backup document for AIAA Synoptic scheduled for publication in AIAA Journal on Feb. 1972
Avail: NTIS CSCL 21C

The familiar axisymmetric MPD thruster is considered with a conical tungsten tip cathode, and a copper plate anode orifice. The performance of such thrusters is investigated, with millisecond pulses, over a wide range of experimental conditions. The five noble gases are used as propellants, at flow rates in the range 0.1 to 100 g-sec (-1). MPD currents 5 to 50 KA are employed and the corresponding input powers are in the range 0.1 to 10 Mw. Thrust is determined from impulse measurements with well known current waveforms, while instantaneous measurements are made for all other variables. A detailed analysis of the experimental results shows that the MPD performance is limited by a critical value which depends only on MPD geometry and on propellant properties. MPD operation, beyond the critical point, becomes increasingly objectionable on account of instabilities, sharp rise of the voltage, erosion and participation of spurious propellant. At the limit of credible MPD operation, the specific impulse depends on propellant properties only, and varies from about 3000 seconds for lighter propellants, to about 400 seconds for heavier propellants. In the same range, the maximum credible MPD efficiency varies from about 30% to about 10%. However, the efficiency depends on other MPD conditions also. Author

29 SPACE RADIATION

Includes cosmic radiation; solar flares; solar radiation; and Van Allen radiation belts. For related information see also 13 Geophysics; and 24 Physics, Atomic, Molecular, and Nuclear.

N71-38544*# Washington Univ., St. Louis, Mo. Lab. for Space Physics.
OBSERVATION OF VH AND VVH COSMIC RAYS WITH AN IONIZATION-CERENKOV DETECTOR SYSTEM
J. I. Fernandez, M. H. Israel, J. Klarmann, R. A. Mewaldt, and W. R. Binns (McDonnell-Douglas Co., St. Louis, Mo.) 1971 7 p refs Presented at 12th Intern. Conf. on Cosmic Rays, Hobart, Tasmania, Aug. 1971 Supported in part by McDonnell-Douglas Corp., Independent Res. and Develop. Program and by the Alfred P. Sloan Found.
(Grant NGR-26-008-001)
(NASA-CR-123197; OG-73) Avail: NTIS CSCL 04A

A detector system including parallel-plate pulse ionization chambers and a Lucite Cerenkov counter, having a geometry factor of 0.92 sq m ster, was operated during a series of balloon flights near 4.5 g/sq cm atmospheric depth at geomagnetic cutoffs near 4.5 GV and 1.8 GV. Charge spectra and flux ratios are presented. The results for very heavy (VH) nuclei are consistent with a cosmic ray source having J(21) less than or equal to Z less than or equal to 24) = 0 and J(20)/J(28) = 0.12 + or - 0.06. The results for ultraheavy (VVH) nuclei are consistent with the dominant mode of nucleosynthesis for these nuclei (rapid neutron capture). Author

N71-38545*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MILLISECOND-TIME-SCALE ATMOSPHERIC LIGHT PULSES INDUCED BY SOLAR ACTIVITY
H. Gelman (Middle East Tech. Univ.), A. Fisher (Middle East Tech. Univ.), and D. Bertsch Sep. 1971 14 p refs
(NASA-TM-X-65718; X-662-71-383) Avail: NTIS CSCL 03B

A wide-angle photomultiplier system designed to detect fluorescence light emission induced by bursts of energetic photons of cosmic origin is reported. A class of fast atmospheric pulsations (FAP) of millisecond time scale was discovered. The physical extent of the atmosphere involved in this emission is around 100 km. Nights with very high FAP rates appear to be correlated with strong solar activity. It is suggested that these events are caused by instabilities associated with particles stored in the magnetosphere. Author

N71-38546*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
VAN ALLEN BELT RADIATION ON TIROS/TOS/ITOS SPACECRAFTS
E. G. Stassinopoulos Sep. 1971 50 p ref
(NASA-TM-X-65717; X-641-71-413) Avail: NTIS CSCL 03B

Calculations proposed for the two Tiros orbits are summarized for electrons and protons. The superimposed spectral distribution for the two trajectories are given graphically for each type of particle, and a selected set of integral energies is plotted versus altitude for electrons and protons. Finally, for each of the two flight paths two computer plots are included depicting the characteristic averaged instantaneous intensities of the trajectory in terms of constant L-bands of .1 earth radius width and the percent of total lifetime spent in each L-interval. E.M.E.

N71-38547*# California Univ., La Jolla. Dept. of Applied Physics and Information Science
A TWO-FLUID SOLAR WIND MODEL WITH ANISOTROPIC PROTON TEMPERATURE
E. Lee and W. I. Axford Sep. 1971 30 p refs
(Grant NGR-05-009-081)
(NASA-CR-123113) Avail: NTIS CSCL 03B

A two-fluid model of the solar wind with anisotropic proton temperature and allowing for extended coronal proton-heating is considered for the case of a purely radial and of a spiral magnetic field. Proton-proton Coulomb-collisions together with a spiral interplanetary magnetic field are found to be sufficient to reduce the thermal anisotropy in the proton gas to a value in agreement with observations. Reasonable values are obtained for the flow velocity, number density and the proton-temperature near the orbit of the earth. Author

N71-38548*# Maryland Univ., College Park. Inst. for Fluid Dynamics and Applied Mathematics.
HYDROGEN AND HELIUM VELOCITIES IN THE SOLAR WIND
K. W. Ogilvie and H. J. Zwally Aug. 1971 17 p refs
(Grant NGR-21-002-311)
(NASA-CR-123119; BN-711) Avail: NTIS CSCL 03B

Examination of separately determined Helium and Hydrogen bulk speeds in the solar wind show these to be equal, both on time scales of 30 minutes and 3 minutes. Observations of two interplanetary shocks and 12 discontinuities show the changes in bulk speed across them to take place simultaneously for the two species. Observations made at times of high Helium abundance following an interplanetary shock, and at times of observation of colliding streams in the plasma, confirm the conclusion that, if bulk speed differences between species occur, they do so very rarely. Author

N71-38549*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
SUPRATHERMAL ELECTRONS IN A SOLAR ECLIPSE
Final Report
G. W. Sharp [1971] 39 p refs
(Contract NASw-2003)
(NASA-CR-123121; LMSC/D243964) Avail: NTIS CSCL 03B

The results of efforts to study the changes in the suprathermal electron flux caused by the total solar eclipse of March 7, 1970 are described. The measurement was made with a retarding potential analyzer, mounted to view out the side of the rocket on Nike-Apache 14.457, which was launched from Wallops Island, Virginia at 1338:30 Local Time, March 7, 1970. For comparison a control experiment was conducted in which an identical analyzer was flown, mounted looking out the side of Nike-Apache 14.456, from Wallops Island at the same local time but on the previous day, March 6, 1970. Differential photoelectron flux in the energy range, 3 to 50 electron volts, and in the altitude range 120-180 km was measured both during the solar eclipse of March 7, 1970 and the day before at the same local time. The differential electron flux energy spectrum measured within totality had the same shape, but was a factor of ten smaller than that measured on the control day for altitudes between 120 and 180 km. This result directly implies that ionizing radiation responsible for the E and F1 ionospheric regions was reduced by a factor of ten during totality. Author

N71-38550*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MAGNETIC FIELD ANOMALIES IN THE LUNAR WAKE
Y. C. Whang and Norman F. Ness (Catholic Univ. of Am., Washington) [1971] 23 p refs
(Grant NGR-09-005-063)
(NASA-TM-X-67329) Avail: NTIS CSCL 03B

A statistical study of the umbral increases and penumbral decreases and increases conducted with variation of the solar wind plasma beta value, the distance from the moon, and the selenographic longitude of the limb regions of the lunar surface in the solar wind flow. All lunar wake anomalies show a strong positive correlation with the plasma beta value while only penumbral increases show a marked variation with distance from the moon. There is no unique correlation of penumbral anomaly occurrence with selenographic longitude of the exposed lunar limb in the solar wind flow. Author

N71-38551*# Iowa Univ., Iowa City. Dept. of Physics and Astronomy
VARIABILITY OF THE INTENSITY RATIOS, PROTONS/ALPHAS, AND ALPHAS/MEDIUM NUCLEI DURING SOLAR PARTICLE EVENTS
J. A. Van Allen, P. Venkatarangan, and D. Venkatesan (Calgary Univ., Alberta) Aug. 1971 21 p refs
(Grants NGL-16-001-002; A-3865; Contract N00014-68-A-0196-003)
(Rept-71-26; NASA-CR-123164) Avail: NTIS CSCL 03B

A discussion of the intensity ratio of protons to alpha particles (p/alpha) and that of alpha particles to nuclei with Z greater than or equal to 3 (alpha/M) of specific kinetic energy greater than or equal to 0.5 MeV/nucleon is presented. Satellite observations of nine major solar particle events give evidence that changes of alpha/M are caused by changing conditions of the interplanetary medium. Theoretical considerations attribute these changes to reflections of energetic particles by moving magnetic mirrors in the solar plasma, which process also causes Forbush decreases. G.G.

N71-38552# California Univ., Berkeley. Lawrence Radiation Lab.
AN EXPERIMENTAL MEASUREMENT OF GALACTIC COSMIC RADIATION DOSE IN CONVENTIONAL AIRCRAFT BETWEEN SAN FRANCISCO AND LONDON COMPARED TO THEORETICAL VALUES FOR CONVENTIONAL AND SUPERSONIC AIRCRAFT
Roger Wallace and Michael F. Boyer 25 Feb. 1971 23 p refs Presented at the Symp. on Natural and Manmade Radiation in Space, Las Vegas, Nev., 1 Mar. 1971
(Contract W-7405-eng-48)
(UCRL-20209; Conf-710304-11) Avail: NTIS

By utilizing bets-gamma and NTA photographic emulsions and thermoluminescent dosimeters, measurements of radiation dose were made in conventional jet aircraft. These direct measurements were in fair agreement with computations made using a program that takes into consideration both basic cosmic ray atmospheric physics and the focusing effect of the earth's magnetic field. These measurements also agreed with those made at supersonic jet aircraft altitudes in RB-57 aircraft. It was concluded that both experiments and theory show that the doses received at conventional jet aircraft altitudes are slightly higher than those encountered in supersonic flights at much higher altitudes, when the long time of exposure at the lower altitudes is taken into consideration. Author (NSA)

N71-38553# Lockheed Missiles and Space Co., Palo Alto, Calif.
ON THE NATURE OF THE RADIATION BACKGROUND AT 250-500 km ALTITUDES
L. V. Kumosova et al 1970 12 p refs Transl. into ENGLISH from Kosmich. issled. (USSR), v. 9, no. 1, 1971 p 105-115
Avail: NTIS; National Translations Center, John Crerar Library, Chicago, Ill. 60616

A brief description is given of the Cosmos-226 experiment on recording electrons at 200 to 300 km altitude. The guiding telescope with two scintillators and a gas Cerenkov counter, and the device to record showers formed by the electrons incident on the unit are included. From an analysis of the experimental results, it is hypothesized that the charged particles observed at these altitudes, whose flux noticeably exceeds the flux of cosmic ray particles, are among those trapped in the earth's magnetic field, and move in the form of bunches. It is also proposed that the bunches could originate when accelerating mechanisms act near the earth. It is possible that the particle group acceleration process is generally characteristic for all regions of the radiation belt. J.M.

N71-38554# National Univ. of Ireland, Dublin. Dept. of Physics.
A RADIO PARTICLE CORRELATION EXPERIMENT ON EXTENSIVE AIR SHOWERS
G. A. Baird 1970 9 p refs Repr. from Acta Phys. Acad. Sci. Hung. (Hungary), v. 29, suppl. 3, 1970 p 751-756 refs Presented at 11th Intern. Conf. on Cosmic Rays, Budapest, 1969 Prepared in cooperation with UKAEA, Harwell, Engl.
(Grant AF-EOAR-0027-67)
(AD-727429; AFOSR-71-2097TR; EAS-71) Avail: NTIS CSCL 04/1

A twofold coincident radio receiving system at 44 MHz center frequency has been used to study radio pulses received at large zenith angles from extensive air showers. A trigger from the coincident radio system interrogated a particle counter and the video output of an independent radio receiver. The preliminary analysis indicates that radio-particle coincidences occur at a rate of 0.04 events/hr above the random expectation. The video waveform of events associated with particles does not differ in a significant manner from the waveform of other groups of events.
Author (GRA)

N71-38555 National Lending Library for Science and Technology, Boston Spa (England).
EFFECT OF SOLAR ACTIVITY ON THE FORMATION OF CIRCULATION EPOCHS AND THEIR STAGES
M. S. Bolotinskaja et al 2 Mar. 1971 23 p refs Transl. into ENGLISH from Arkt. Antarkt. Nauc-Issled Inst. (Leningrad), T289, 1969 p 132-151
(NLL-M-20361-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

The effects of solar activity on the formation of circulation epochs in the earth atmosphere are discussed. Variations in the frequency of types and sub-types of circulation within the 11 year cycle of solar activity and significant differences in the frequency in even and odd 11 year cycles are presented. The occurrence of circulation epochs is presented.
P.N.F.

N71-38556 National Lending Library for Science and Technology, Boston Spa (England).
THE BIOGRAPHY OF COSMIC RAYS
A. Akhiezer 13 Apr. 1971 5 p Transl. into ENGLISH from Reb. Gazeta (USSR), 15 Nov. 1970
(NLL-M-20419-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

Investigations of the extended air showers which arise from high energy cosmic protons or nuclei and which eventually produce negatively charged radio waves are briefly described. The radio emission was discovered by simultaneously recording the Cerenkov light flash in the passage of shower particles and the short-term impulse of radio emission produced by electrons. Further measurements indicated the importance of the interaction of electrons and positrons in the extended showers with the geomagnetic field. Data were also obtained on radiation polarization, frequency and spaces distribution, and other extended shower characteristics.
N.E.N.

N71-38557 National Lending Library for Science and Technology, Boston Spa (England).
SECULAR VARIATION OF INTENSITY OF DIRECT SOLAR RADIATION IN TBILISI
N. A. Aslanikasvili May 1968 6 p refs Transl. into ENGLISH from Glav. Geof. Obs., Atmos. Optics, (Leningrad), 1969 p 169-172
(NLL-M-20365-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupons

The extent of radiation attenuation due to aerosols was studied. Solar radiation data for 1928 to 1964 were used, as well as water vapor pressure and ozone data. The amount of atmospheric dust over Tbilisi, in the Georgian S.S.R., has increased during recent decades at an increasing rate due to human activity. This is a global phenomenon.
K.P.D.

N71-38581# Academy of Sciences (USSR), Moscow.
A MODERN PICTURE OF THE ACCELERATION AND PROPAGATION OF SOLAR COSMIC RAYS
L. I. Miroshnichenko *In its* Proc. of the 6th Ann. All-Union Winter School on Space Phys., Part 2 1969 p 31-35 refs In RUSSIAN (See N71-38582 24-30)
Avail: NTIS

N71-38582# Academy of Sciences (USSR), Moscow.
THE COSMIC RAY ENERGY SPECTRUM IN INTERSTELLAR SPACE
A. N. Charakhchyan and T. N. Charakhchyan *In its* Proc. of the 6th Ann. All-Union Winter School on Space Phys., Part 2 1969 p 36-40 refs In RUSSIAN (See N71-38582 24-30)
Avail: NTIS

N71-38583# Academy of Sciences (USSR), Moscow.
THE COEFFICIENT OF DIFFUSION FOR COSMIC RAYS
A. N. Charakhchyan and T. N. Charakhchyan *In its* Proc. of the 6th Ann. All-Union Winter School on Space Phys., Part 2 1969 p 41-48 refs In RUSSIAN (See N71-38582 24-30)
Avail: NTIS

N71-38584# Academy of Sciences (USSR), Moscow.
DIFFUSION OF RELATIVISTIC ELECTRONS IN THE GALAXY AND THEIR ENERGY SPECTRUM
V. A. Dogel and S. I. Syrovatskiy *In its* Proc. of the 6th Ann. All-Union Winter School on Space Phys., Part 2 1969 p 49-51 refs In RUSSIAN (See N71-38582 24-30)
Avail: NTIS

N71-38585# Academy of Sciences (USSR), Moscow.
ULTRAHIGH ENERGY COSMIC RAYS
G. B. Kristiansen *In its* Proc. of the 6th Ann. All-Union Winter School on Space Phys., Part 2 1969 p 52-59 refs In RUSSIAN (See N71-38582 24-30)
Avail: NTIS

N71-38586# Academy of Sciences (USSR), Moscow.
TWENTY-SEVEN-DAY VARIATIONS OF COSMIC RAYS, BASED ON GROUND AND STRATOSPHERIC OBSERVATIONS, 1966-1967
L. Kh. Shatashvili *In its* Proc. of the 6th Ann. All-Union Winter School on Space Phys., Part 2 1969 p 60-64 refs In RUSSIAN (See N71-38582 24-30)
Avail: NTIS

N71-38587# Academy of Sciences (USSR), Moscow.
MEASURING THE ANISOTROPY OF COSMIC RAYS DURING A SOLAR CYCLE
K. K. Fedchenko *In its* Proc. of the 6th Ann. All-Union Winter School on Space Phys., Part 2 1969 p 65-67 refs In RUSSIAN (See N71-38582 24-30)
Avail: NTIS

N71-38588# Academy of Sciences (USSR), Moscow.
ELEVEN-YEAR MODULATION OF THE INTENSITY OF GALACTIC COSMIC RAYS AND THE HELIOGRAPHIC DISTRIBUTION OF SUNSPOTS
Yu. I. Stozhkov *In its* Proc. of the 6th Ann. All-Union Winter School on Space Phys., Part 2 1969 p 68-71 refs In RUSSIAN (See N71-38582 24-30)
Avail: NTIS

N71-38589# Academy of Sciences (USSR), Moscow.
MODULATION OF GALACTIC COSMIC RAYS
A. G. Zusevanovich, Ye. V. Kolomeyets, and Yu. A. Shakhova *In its* proc. of the 6th Ann. All-Union Winter School on Space

Phys., Part 2 1969 p 72-75 refs In RUSSIAN (See N71-38582 24-30)
Avail: NTIS

N71-38600# Academy of Sciences (USSR), Moscow.
THE TWENTY-SEVEN-DAY VARIATIONS IN COSMIC RAY INTENSITY AND SOLAR ACTIVITY IN THE PERIOD 1966-1967
V. P. Okhlopov *In its* Proc. of the 6th Ann. All-Union Winter School on Space Phys., Part 2 1969 p 76 In RUSSIAN (See N71-38582 24-30)
Avail: NTIS

N71-38601# Academy of Sciences (USSR), Moscow.
FLUCTUATIONS OF GALACTIC COSMIC RAYS OF INTERPLANETARY ORIGIN
V. I. Shishov *In its* Proc. of the 6th Ann. All-Union Winter School on Space Phys., Part 2 1969 p 77 In RUSSIAN (See N71-38582 24-30)
Avail: NTIS

N71-38602# Academy of Sciences (USSR), Moscow.
THE BAROMETRIC COEFFICIENT OF THE NEUTRON COMPONENT OF COSMIC RAY INTENSITY AND CALCULATION OF THE EFFECTS OF PROTON AND MU MESON ABSORPTION
M. V. Alaniya and O. G. Rogava *In its* Proc. of the 6th Ann. All-Union Winter School on Space Phys., part 2 1969 p 78 ref In RUSSIAN (See N71-38582 24-30)
Avail: NTIS

N71-38603# Academy of Sciences (USSR), Moscow.
EVALUATIONS OF THE PARTIAL BAROMETRIC COEFFICIENT OF INTEGRAL MULTIPLES FOR THE NEUTRON COMPONENT OF SECONDARY COSMIC RADIATION
L. I. Dorman and A. V. Sergeyev *In its* Proc. of the 6th Ann. All-Union Winter School on Space Phys., part 2 1969 p 79-80 refs In RUSSIAN (See N71-38582 24-30)
Avail: NTIS

N71-38605# Academy of Sciences (USSR), Moscow.
METEORIC VARIATION OF COSMIC RAY INTENSITY IN THE NEIGHBORHOOD OF A NEW MAXIMUM IN SOLAR ACTIVITY, 1967-1968
S. A. Belskiy *In its* Proc. of the 6th Ann. All-Union Winter School on Space Phys., part 2 1969 p 82 In RUSSIAN (See N71-38582 24-30)
Avail: NTIS

N71-38610# Academy of Sciences (USSR), Moscow.
ADJUSTMENT OF MULTIPLE DATA RECORDERS USING A MATHEMATICAL DEVICE
I. N. Kapustin *In its* Proc. of the 6th Ann. All-Union Winter School on Space Phys., part 2 1969 p 117-122 refs In RUSSIAN (See N71-38582 24-30)
Avail: NTIS

N71-38611# Academy of Sciences (USSR), Moscow.
THE EFFECT OF COINCIDENCES DURING MULTIPLE RECORDING OF THE NEUTRON COMPONENT OF COSMIC RAYS
I. N. Kapustin and V. A. Redkevich *In its* Proc. of the 6th Ann. All-Union Winter School on Space Phys., part 2 1969 p 123-124 refs In RUSSIAN (See N71-38582 24-30)
Avail: NTIS

N71-38612# Academy of Sciences (USSR), Moscow.
MACHINE PROCESSING OF COSMIC RAY STATION DATA
V. S. Smirnov and V. G. Ustinovich *In its* Proc. of the 6th Ann. All-Union Winter School on Space Phys., part 2 1969 p 125 In RUSSIAN (See N71-38582 24-30)
Avail: NTIS

N71-38614# Academy of Sciences (USSR), Moscow.
AN ARRANGEMENT FOR OBTAINING THE FIVE-MINUTE VALUE FOR COSMIC RAY INTENSITY
L. A. Sharovalova and V. I. Tergoyev *In its* Proc. of the 6th Ann. All-Union Winter School on Space Phys., part 2 1969 p 128 In RUSSIAN (See N71-38582 24-30)
Avail: NTIS

N71-38620# Academy of Sciences (USSR), Moscow.
POSSIBILITY FOR DETERMINING THE DIRECTION AND POLARIZATION OF GAMMA QUANTA BASED ON TWO SUCCESSIVE OCCURRENCES OF COMPTON SCATTERING IN DETECTOR MATERIAL
G. M. Gorodinskiy and Ye. M. Kruglov *In its* Proc. of the 6th Ann. All-Union Winter School on Space Phys., part 2 1969 p 149-150 refs In RUSSIAN (See N71-38582 24-30)
Avail: NTIS

N71-37911# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
APPLICATION OF SATELLITE BEACON IONOSPHERIC DATA TO SOLAR CORONA FARADAY ROTATION MEASUREMENTS
Charles T. Stelzried *In* Max-Planck-Inst. fuer Aeronomie Future Appl. of Satellite Beacon Expt. Nov. 1970 5 p (See N71-37883 24-13)
Avail: NTIS HC $3.00/MF $0.95

30 SPACE SCIENCES

Includes astronomy and astrophysics; cosmology; lunar and planetary flight and exploration; and theoretical analysis of orbit and trajectory. For related information see also: 11 Facilities, Research and Support; and 31 Space Vehicles.

N71-38558*# California Univ., Santa Barbara. Dept. of Mechanical Engineering.
[SATELLITE STABILITY AND INTERSTELLAR DUST GRAIN STUDIES]
[1971] 31 p refs
(Grant NGL-05-010-020)
(NASA-CR-121929; UCSB-ME-71-2) Avail: NTIS CSCL 22C

CONTENTS:
1. LIBRATIONAL STABILITY CONDITIONS FOR DEPLOYING SATELLITES W. R. Delamater and T. P. Mitchell 12 p refs (See N71-38559 24-30)
2. THE INFLUENCE OF COROTATION ON INTERPLANETARY DUST GRAIN ORBITS T. P. Mitchell 12 p refs (See N71-38560 24-30)
3. A NOTE ON THE RIGID-BODY DYNAMICS OF THE DAVIS-GREENSTEIN EFFECT T. P. Mitchell 7 p refs (See N71-38561 24-30)

N71-38559*# California Univ., Santa Barbara. Dept. of Mechanical Engineering.
LIBRATIONAL STABILITY CONDITIONS FOR DEPLOYING SATELLITES
W. R. Delamater and Thomas P. Mitchell *In its* Satellite Stability and Interstellar Dust Grain Studies 1971 12 p refs (See N71-38558 24-30)
Avail: NTIS CSCL 22C

The equation of planar libration of a satellite in orbit is derived, using the angular velocity, moments of inertia, radius vector of the orbit, and transverse direction. The stability of the

equation solutions is studied, and stability conditions are derived where stability is defined in a physical manner. Stability is examined about a stable equilibrium point, and the coordinate axes are chosen so that this equilibrium point is in the neighborhood of x = 0. Several cases were tested on the computer with various conditions and parametric values; no case was found to be unstable when the theory predicted stability.
J.A.M.

N71-38560*# California Univ., Santa Barbara. Dept. of Mechanical Engineering
THE INFLUENCE OF COROTATION ON INTERPLANETARY DUST GRAIN ORBITS
Thomas P. Mitchell *In its* Satellite Stability and Interstellar dust grain studies 1971 12 p refs (See N71-38558 24-30)
Avail: NTIS CSCL 03B

The perturbative effects of an azimuthal component of the solar wind velocity on the orbital characteristics of gravitationally-bound interplanetary dust grains are analyzed. The azimuthal motion of the wind is assumed to arise from corotation of the solar plasma within a certain region surrounding the sun. It is shown that the azimuthal wind velocity, as distinct from other sources of perturbations, causes a secular decrease of the orbital inclination of the grains. The conditions under which an appreciable decrease in orbital inclination can occur, with a consequent concentration of the dust in the ecliptic, during the Poynting-Robertson lifetime of a grain are discussed. Author

N71-38561*# California Univ., Santa Barbara. Dept. of Mechanical Engineering.
A NOTE ON THE RIGID-BODY DYNAMICS OF THE DAVIS-GREENSTEIN EFFECT
Thomas P. Mitchell *In its* Satellite Stability and Interstellar Dust Grain Studies 1971 7 p refs (See N71-38558 24-30)
Avail: NTIS CSCL 03B

The rigid-body dynamics of an interstellar grain are examined, assuming the Davis-Greenstein mechanism is in effect, and the statistical mechanics of the grains are also evaluated. The dynamical motion is described and analyzed in terms which appear more elementary and direct than those previously employed. The dynamics of a grain are considered in an ensemble of ellipsoidal grains in equilibrium at temperature T.
Author

N71-38562*# Nevada Univ., Reno. Lab. of Atmospheric Physics.
AN INVESTIGATION OF THE LOWER ATMOSPHERE OF VENUS Final Report
Patrick Squires 24 Sep. 1971 24 p refs
(Grant NGR-29-001-035)
(NASA-CR-123203) Avail: NTIS CSCL 03B

The characteristics of the Venusian clouds were studied to determine the type of probes to be designed for cloud measurements. Questions discussed include: stratiform or convective structure of the clouds, cloud depth and optical thickness, condensation aspects, and temperature probes. Instruments recommended for further consideration include: GaAs optical radar for sampling backscattering properties of the clouds, an evaporator to indicate whether the cloud particles are volatile, and a group of instruments for indicating whether icing is occurring. F.O.S.

N71-38563*# Avco Corp., Wilmington, Mass. Government Products Group.
A STUDY OF A JUPITER ATMOSPHERIC ENTRY PROBE MISSION. VOLUME 1: MANGEMENT SUMMARY Final Report
Howard B. Winkler 13 Aug. 1971 85 p Prepared for JPL
(Contracts NAS7-100; JPL-952897)
(NASA-CR-123120; AVSD-0372-71-RR-VOl-1) Avail: NTIS CSCL 22A

The results are presented of a study conducted to screen and identify feasible Jupiter entry probe missions that achieve the science objectives, and that tend to minimize engineering development. Science and engineering tradeoff studies were used to ascertain those missions which would meet the goals. Entry probe supporting systems and subsystem performance requirements were defined based on the favorable mission combinations. The results of configuration descriptions were used to indicate the necessary research and development that must be conducted to enhance the science return, increase the allowable targeting boundaries, and increase mission success. Three major conclusions of the study are: (1) many feasible missions exist, (2) use of remote sensing with radiometers from the base of the clouds in combination with direct sensing during passage through the clouds can be used to achieve the science objectives, and (3) research and development must be pursued to improve probe efficiency. D.L.G.

N71-38564*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE DEEP SPACE NETWORK, VOLUME 5 Progress Report, Jul. - Aug. 1971
15 Oct. 1971 155 p refs
(Contract NAS7-100)
(NASA-CR-122843; JPL-TR-32-1526-Vol-5) Avail: NTIS CSCL 22A

CONTENTS:

1. DESCRIPTION OF THE DEEP SPACE NETWORK: DSN FUNCTIONS AND FACILITIES N. A. Renzetti p 1-3 ref (See N71-38565 24-11)

2. (MISSION SUPPORT: INTERPLANETARY, PLANETARY, AND MANNED SPACE FLIGHT PROJECTS AND RADIO SCIENCE EXPERIMENTS) A. J. Siegmeth, P. S. Goodwin, R. P. Laeser, E. K. Davis, and R. B. Hartley et al p 4-44 refs (See N71-38566 24-30)

3. (ADVANCED ENGINERING: TRACKING AND NAVIGATIONAL ACCURACY ANALYSIS, COMMUNICATIONS SYSTEMS AND ELEMENTS RESEARCH, AND SUPPORTING RESARCH AND TECHNOLOGY) J. L. Fanselow, P. F. MacDoran, J. B. Thomas, J. G. Williams, and C. J. Finnie et al p 45-128 refs (See N71-38567 24-30)

4. (DEVELOPMENT AND IMPLEMENTATION: SPACE FLIGHT OPERATIONS FACILITY AND GROUND COMMUNICATIONS FACILITY DEVELOPMENT) C. L. Zandell and D. S. Bremner p 129-135 refs (See N71-38568 24-22)

N71-38565*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DESCRIPTION OF THE DEEP SPACE NETWORK: DSN FUNCTIONS AND FACILITIES c11
N. A. Renzetti *In its* The Deep Space Network, Vol. 5 15 Oct. 1971 p 1-3 ref (See N71-38564 24-30)
Avail: NTIS CSCL 22A

The objectives, functions, and organization of the Deep Space Network are summarized. The Deep Space Instrumentation Facility, the Ground Communications Facility, and the Space Flight Operations Facility are described. Author

N71-38566*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
[MISSION SUPPORT: INTERPLANETARY, PLANETARY, AND MANNED SPACE FLIGHT PROJECTS AND RADIO SCIENCE EXPERIMENTS]
A. J. Siegmeth, P. S. Goodwin, R. P. Laeser, E. K. Davis, R. B. Hartley et al *In its* The Deep Space Network, Vol. 5 15 Oct. 1971 p 4-44 refs (See N71-38564 24-30)
Avail: NTIS CSCL 22A

The role is described of the Deep Space Network (DSN) in support of the Pioneer, Helios, Mariner Mars 1971, Viking, and Apollo missions. In addition, the use by radio scientists of the DSN's 26- and 64- m antenna stations is reported. The material presented includes the following: (1) The planned functions of the DSN telemetry, tracking, and command systems in support

of the Pioneer F and G missions are defined. (2) A description of the Helios spacecraft's command system is given which includes its requirements and conceptual block diagrams. (3) The final steps of implementation of the tracking and data acquisition function for the Mariner Mars 1971 mission are outlined. (4) A summary is presented of accomplishments in support of the Viking project that involve long-range planning with problem identification and resolution. (5) The support provided by the DSN to the Manned Space Flight Network during the Apollo 15 mission is described. D.L.G.

N71-38567*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
[ADVANCED ENGINEERING: TRACKING AND NAVIGATIONAL ACCURACY ANALYSIS, COMMUNICATIONS SYSTEMS AND ELEMENTS RESEARCH, AND SUPPORTING RESEARCH AND TECHNOLOGY]
J. L. Fanselow, P. F. MacDoran, J. B. Thomas, J. G. Williams, C. J. Finnie et al *In its* The Deep Space Network, Vol. 5 15 Oct. 1971 p 45-128 refs (See N71-38564 24-30)
Avail: NTIS CSCL 22A

Articles dealing with instrumentation and techniques are presented. Topics discussed include: (1) applications of very long baseline interferometry to earth physics; (2) Faraday rotation measurements of the ionosphere; (3) Cowell's method compared with a variation-of-parameters method for the computation of precision satellite orbits; (4) bounds on the fan-out s combinational complexity of functions; (5) test based on sequential maximum likelihood ratio methods for exponential distributions; (6) mathematical theory of complexity; (7) matrix multiplication problem; (8) tracking and data acquisition; (9) superconducting magnet for (Ku-band) traveling wave maser; and (10) wind tunnel models of reflectors for measurement of wind pressure coefficients. D.L.G.

N71-38568*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
[DEVELOPMENT AND IMPLEMENTATION: SPACE FLIGHT OPERATIONS FACILITY AND GROUND COMMUNICATIONS FACILITY DEVELOPMENT] o11
C. L. Zandell and D. S. Bremner *In its* The Deep Space Network, Vol. 5 15 Oct. 1971 p 129-135 refs (See N71-38564 24-30)
Avail: NTIS CSCL 14B

The major hardware/software problem areas are defined for the central processing system of the Mark 3A Space Flight Operations Facility. The results of studies made to resolve these problem areas are included. In addition, a functional description is given of the high speed data system for the Ground Communications Facility. D.L.G.

N71-38569*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
OPERATIONS AND FACILITIES: PIONEER F AND G MISSION SUPPORT AREA o11
A. H. Hofmann *In its* The Deep Space Network, Vol. 5 15 Oct. 1971 p 136-145 refs (See N71-38564 24-30)
Avail: NTIS CSCL 14B

A description is presented of the mission support area for the Pioneer F and G Jupiter fly-by missions. The complexity of these missions necessitated a larger floor space than was available within the Space Flight Operations Facility (SFOF). A brief discussion is given of some anticipated operational problems caused by the mission support area's remote location from the SFOF. D.L.G.

N71-38570*# Chicago Univ., Ill. Enrico Fermi Inst.
CONDITIONS IN THE EARLY SOLAR SYSTEM, AS INFERRED FROM METEORITES
Edward Anders Sep. 1971 39 p refs Presented at Nobel Symp. No. 21, from Plasma to Planet, Saltsjoebaden, Sweden, 6-10 Sep. 1971
(Grant NGL-14-001-010; Contract AT(11-1)-382)
(NASA-CR-123180; EFI-71-40; COO-382-118) Avail: NTIS CSCL 03B

The properties of meteorites are discussed in terms of inferring the origin of meteorites and planets. Topics discussed include: (1) condensation sequence of cosmic gas, (2) chemical fractionation in chondrites, (3) organic matter, (4) primordial noble gases, and (5) chronology. It is concluded that meteorites and planets formed from a hot solar nebula of approximately 0.1 to 1 solar mass. F.O.S.

N71-38571*# Massachusetts Inst. of Tech., Cambridge. Center for Space Research.
EXPLORER 33 AND EXPLORER 35 PLASMA OBSERVATIONS OF THE INTERACTION REGION BETWEEN THE SOLAR WIND AND THE MAGNETIC FIELD OF THE EARTH
Herbert Charles Howe (Ph.D. Thesis) 7 May 1971 218 p refs Sponsored in part by NSF
(Grant NGR-22-009-372)
(NASA-CR-123195; CSR-TR-71-1) Avail: NTIS CSCL 03B

The magnetopause, magnetosheath, and bow shock were studied using data from M.I.T. plasma experiments on the earth orbiting Explorer 33 and the lunar orbiting Explorer 35. Dual satellite observations of bow shock and magnetopause motion showed that, in the examples studied, the motion is often directly related to measured changes in solar wind direction and/or dynamic pressure. One example, however, shows frequent motion of the magnetotail boundary in the presence of a steady, nonfluctuating solar wind. A statistical study of this transverse random motion at lunar distance indicates the motion consists of two superimposed components with characteristic time scales of 15 minutes and approximately 1 hour. A model of the boundary motion indicates the second motion has an amplitude 2-3 times as large as the first motion. Also, the total boundary motion amplitude on the dawn side is approximately 2 times larger than on the dusk side. The magnetosheath flow was mapped using dual satellite observations to separte temporal and special variations. The overall flow pattern was found to agree well with the predictions of hydrodynamic theory. Author

N71-38572*# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.
RESEARCH IN SPACE PHYSICS AT THE UNIVERSITY OF IOWA Annual Report, 1971
J. A. Van Allen 19 Aug. 1971 28 p refs
(Grant NGL-16-001-002)
(NASA-CR-123150) Avail: NTIS CSCL 03C

Progress is reported on observational work in space physics using a wide diversity of detectors on earth and lunar satellites and on planetary and interplanetary spacecraft with phenomenological analysis and interpretation. Ground based radio-astronomical and optical techniques, and basic related problems in plasma physics are emphasized. The research aims at extending the knowledge of energetic particles in outer space and determining their relationships to electric, magnetic, and electromagnetic fields associated with the earth, the sun, the moon, the planets, and the interplanetary medium. E.M.C.

N71-38573*# IIT Research Inst., Chicago, Ill. Astro Sciences.
SPECTROSCOPIC OBSERVATIONS OF THE PLANETS Final Report
A. B. Binder [1971] 38 p refs
(Contract NASw-1883)
(NASA-CR-123152) Avail: NTIS CSCL 03A

Results obtained from a series of 10 channel IR spectrophotometer observations of the 1.5 micrometers window of Jupiter are described. These results show that the NH3 and CH4 absorptions increase with increasing air mass along N-S traces taken at the central meridian of Jupiter and decrease with increasing air mass along E-W traces taken along the Jovian belts and zones. These variations in the absorptions over the disk indicate that the NH3 and CH4 bands are being formed in a

scattering atmosphere rather than an atmosphere with a simple reflecting cloud layer. The results also show that the absorptions over the south tropical zone are considerably greater than for the rest of the features at equivalent air mass while the absorptions over the Great Red Spot are considerably less than for other features. The data were also used to show that the Minnaert function can be used to describe the limb darkening of Jupiter, at least at 1.5 micrometers, and that the scattering layer behaves like a Lambertian surface. Author

N71-38574*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE 8 JULY 1966 INTERPLANETARY SHOCK NORMAL IN THE VICINITY OF THE EARTH
R. P. Lepping Sep. 1971 21 p refs Submitted for publication
(NASA-TM-X-65720; X-692-71-365) Avail: NTIS CSCL 03B

The interplanetary shock speed and surface normal have been accurately estimated and shown to be in serious disagreement with previously estimated values. The shock speed was 570 + or - 20 km/sec and the normal had a direction given by theta sub SE = -38 deg + or - 7 deg and phi sub SE = 166 deg + or - 7 deg. These values yielded the most consistent picture of the event where the following constraints were put on the estimation: (1) the MHD shock conservation equations had to be satisfied and (2) the time-of-sighting restriction for the shock passage between Explorers 28 and 33, both in interplanetary space, had to be fulfilled. Vela 3A, which was in the magnetosheath at the time of its shock sighting, observed the shock 3.0 + or - 2.1 min. later than might be expected from the simple model of a shock front remaining plane and constant in both speed and (normal) direction after interaction with the bow shock. The lower end of this range (1 min.) is not inconsistent with the delay time obtained in studying the January 11, 1968 traveling shock-bow shock interaction. The traveling shock probably experienced a rapid slowing-down and significant distortion from a plane shape in the sunward region of the earth's magnetosheath. Author

N71-38575*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
INVESTIGATION OF GLASS PARTICLES RECOVERED FROM APOLLO 11 AND 12 FINES: IMPLICATIONS CONCERNING THE COMPOSITION OF THE LUNAR SURFACE
Billy P. Glass Oct. 1971 80 p refs Submitted for publication
(NASA-TM-X-65724; X-644-71-414) Avail: NTIS CSCL 03B

Analyses of Apollo 11 and Apollo 12 glasses provide evidence for at least five major rock types on the lunar surface. Glasses produced by impact melting of these rocks and the rock types from they were derived are as follows: basaltic, anorthositic, high alkali and phosphorous glasses (KREEP), and ultrabasic glasses with low Al2O3 and high FeO. Glasses are a major component of the lunar fines, and provide much useful information concerning the composition and heterogeneity of the lunar surface. Author

N71-38576*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A THEORETICAL MODEL OF THE IONOSPHERE DYNAMICS WITH INTERHEMISPHERIC COUPLING
H. G. Mayr, E. G. Fontheim (Michigan Univ., Ann Arbor), L. H. Brace, H. C. Brinton, and H. A. Taylor, Jr. Oct. 1971 50 p refs Presented at the Conf. on Theoret. Ionosphere Models, University Park, Pa., 14-16 Jun. 1971 Submitted for publication
(Grant NGR-23-005-015)
(NASA-TM-X-65727; X-621-71-422) Avail: NTIS CSCL 03C

The ionospheric plasma is described by means of the momentum and continuity equations for O(+), He(+), H(+) and the energy equations for T sub e and T sub i. The ion production rate profiles and the photoelectron heating rates to the plasma are computed seperately and serve as source functions in the continuity and energy equations respectively. Charge transfer, collisional energy loss processes, ion-neutral drag, diffusion and electron heat conduction are among the physical processes included in the calculations. Assuming steady state, the equations are transformed into integral equations and then solved iteratively along geomagnetic field lines from the region of chemical equilibrium up to the equatorial plane. Extension of this model to include time dependent phenomena is presented. Author

N71-38577*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ON ESTIMATING THE VENUS SPIN VECTOR FROM DATA OBTAINED DURING THE PLANETARY EXPLORER MISSION
Peter Argentiero and George Wyatt Oct. 1971 25 p refs Submitted for publication
(NASA-TM-X-65728; X-551-71-426) Avail: NTIS CSCL 03C

The feasibility of obtaining improved estimates of the Venus spin vector through a least squares processing of range rate data from planetary expiration probes on the surface of Venus is demonstrated. It is shown that the probes need transmit data only for a few moments after landing in order to obtain accurate estimates. This procedure estimates the right ascension of the spin vector better than the declination. The estimation procedure remains viable even if a few of the probes do not survive impact. Some improvement in the estimates of probe locations is also obtainable. Author

N71-38578*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE INFLUENCE OF THE IONIZED MEDIUM ON SYNCHROTRON EMISSION IN INTERSTELLAR SPACE
Reuven Ramaty Oct. 1971 15 p refs Submitted for publication
(NASA-TM-X-65729; X-660-71-429) Avail: NTIS CSCL 03B

The effect of the ionized gas on synchrotron emission in the interstellar medium is investigated. A detailed calculation of the synchrotron emissivity of cosmic electrons is made as a function of frequency and observation angle with respect to the field. The results are presented both as a local emissivity, and as an intensity, the latter obtained by neglecting free-free absorption in the interstellar medium and by assuming that the emissivity is constant along the line of sight. The comparison of these results with previous studies on the nature of the low-frequency turnover of the galactic nonthermal radio background reveals that, the suppression of synchrotron emission by the ambient electrons has in general a lesser effect than free-free absorption by these electron. Author

N71-38579*# National Aeronautics and Space Administration. Washington, D.C.
APOLLO 15 AT HADLEY BASE
1971 34 p Original contains color illustrations
(NASA-EP-94) Avail: NTIS; SOD $0.75 CSCL 22C

Highlights of the Apollo 15 flight are briefly described and illustrated with photographs. Emphasis is on the lunar rover traverses and the type of information expected to be obtained. N.E.N.

N71-38580*# National Aeronautics and Space Administration. Washington, D.C.
TECHNIQUES OF ASTRONOMY VIA BALLOON [LES TECHNIQUES DE L'ASTRONOMIE EN BALLON]
A. Mizzi Jul. 1969 14 p Transl. into ENGLISH from Rech. Spatiale (France), v. 7, Feb 1968 p 20-26
(NASA-TT-F-12339) Avail: NTIS CSCL 03A

The use of balloons for lifting an astronomical observatory to an altitude of 30 to 40 km is discussed. The capsule astrolab and the principles for orienting the nacelle are described, and the results obtained from seven successful flights are included. P.O.S.

N71-38581*# North American Rockwell Corp., Downey, Calif. Space Div.
REMOTE SENSOR SYSTEMS FOR UNMANNED PLANETARY MISSIONS
Sep. 1970 380 p refs
(Contract NAS2-5647)
(NASA-CR-114371; SD-70-361-1) Avail: NTIS HC $6.00/MF $0.95 CSCL 22C

The specific objectives of the study covered in this report are to (1) define remote sensor types compatible with the observation objectives previously determined; (2) develop scaling laws depicting design and performance versus support requirements; (3) develop a computer program for application of these scaling laws; (4) develop trajectory parameters for selected outer planet missions; and (5) define future sensor development requirements to better fulfill the observation objectives as previously defined. The candidate remote sensor types identified for each of the previously identified objectives are discussed. The development of a computer program for evaluation of sensor measurement requirements is included. The development of the scaling laws for the various types of instruments considered and the methodology for application of these are considered. A computer program for application of the scaling laws is discussed, and an example presented. Author

N71-38582# Academy of Sciences (USSR), Moscow. Scientific Commission on the Problem of Cosmic Rays.
PROCEEDINGS OF THE SIXTH ANNUAL ALL UNION WINTER SCHOOL ON SPACE PHYSICS, PART 2
S. N. Vernova, ed., G. Ye. Kocharova, ed., and S. M. Kirova, ed. Apatity, Murmansk 1969 186 p refs In RUSSIAN Presented at Apatity, Murmansk, 18 Mar.-1 Apr. 1969 2 Vol.
Avail: NTIS

Problems of comets and meteorites in space research are considered. Energy spectra, variations, and propagation of cosmic rays are discussed. Instruments and methodology of astronomical and astrophysical research are reviewed. For individual titles, see N71-38583 through N71-38625.

N71-38583# Academy of Sciences (USSR), Moscow.
COMETS IN SPACE
A. Z. Dolginov *In its* Proc. of the 6th Ann. All-Union Winter School on Space Phys., part 2 1969 p 5-14 refs In RUSSIAN (See N71-38582 24-30)
Avail: NTIS

Comet phenomena theory is discussed. Physical and chemical characteristics of comets are considered. Kinetic equations are presented for neutral gas molecules in the head of a comet. The origin of dust which makes up the comet atmosphere is discussed. The comet plasma and distribution equations are also evaluated. Transl. by K.P.D.

N71-38584# Academy of Sciences (USSR), Moscow.
LABORATORY SIMULATION OF COMET PHENOMENA c33
Ye. A. Kaymakov and V. I. Sharkov *In its* Proc. of the 6th Ann. All-Union Winter School on Space phys., part 2 1969 p 15-20 refs In RUSSIAN (See N71-38582 24-30)
Avail: NTIS

Experiments on the sublimation of ice were conducted. The equilibrium temperature of ice depends on the relative energy input to its surface. Ice flow and heat of sublimation were also determined. Transl. by K.P.D.

N71-38585# Academy of Sciences (USSR), Moscow.
ABSOLUTE PHOTOMETRY OF COMET NUCLEI BASED ON THE FOCAL IMAGES OF STARS c14
V. I. Churyumov *In its* Proc. of the 6th Ann. All-Union Winter School on Space Phys., Part 2 1969 p 21 In RUSSIAN (See N71-38582 24-30)
Avail: NTIS

A method for absolute photometry is presented for images lying in the region of normal darkening for short focus cameras of the Astropetsval (f = 60 cm) and Telemar (f = 100cm) types. This method uses stellar streaks obtained on photographic plates during comet tracking as calibration points for constructing the characteristic curve. The effective (average) density of stellar images is measured by microphotometer or densitometer. Transl. by K.P.D.

N71-38586# Academy of Sciences (USSR), Moscow.
A TWO-COLOR STUDY OF THE LUMINOSITY OF THE KHOND COMETS OF 1968
K. I. Churyumov and T. Mayzlina *In its* Proc. of the 6th Ann. All-Union Winter School on Space Phys., Part 2 1969 p 22 In RUSSIAN (See N71-38582 24-30)
Avail: NTIS

Comets are considered in their role as indicators of conditions in interplanetary space. They can be used for studies at high heliographic latitudes and large heliographic distances. Comet reactions to changing situations in the interplanetary medium may be recognized by such characteristics as strong oscillation in the luminosity of the nucleus, variations in orientation of the plasma tail dependent on the long radius vector, radiation activity of the comet plasma, and halo formation. Transl. by K.P.D.

N71-38587# Academy of Sciences (USSR), Moscow.
STUDY OF THE ACTIVITY OF THE IKEYA-SEKI
A. A. Demenko and K. I. Churyumov *In its* Proc. of the 6th Ann. All-Union Winter School on Space Phys., Part 2 1969 p 23 In RUSSIAN (See N71-38582 24-30)
Avail: NTIS

Oscillations in comet luminosity are indicators of interplanetary conditions. Comets, having rarefied, often ionized, extended atmospheres, are natural sondes, and they accurately reflect changes in parameters of the interplanetary plasma. Photographs and visual spectra taken during the period of March 10 - June 3, 1968 were studied. The resonance character of the comet nucleus was observed. Transl. by K.P.D.

N71-38588# Academy of Sciences (USSR), Moscow.
DYNAMIC PROCESSES OF COMETS AND THEIR ANALOGY WITH THE DYNAMICS OF THE EARTH'S MAGNETOSPHERE
Z. M. Ioffe *In its* Proc. of the 6th Ann. All-Union Winter School on Space Phys., Part 2 1969 p 24 refs In RUSSIAN (See N71-38582 24-30)
Avail: NTIS

Interaction between the solar wind and the ion component of comet atmospheres leads to comet streamlining similar to the streamlining of the magnetosphere by the solar wind. Shock wave features, the so-called magnetic tail of the earth, magnetic field structure, and plasma stream density are considered. Transl. by K.P.D.

N71-38589# Academy of Sciences (USSR), Moscow.
LUNAR MORPHOLOGY AND A STUDY OF THE CHEMICAL COMPOSITION OF THE LUNAR SURFACE
S. V. Victorov *In its* Proc. of the 6th Ann. All-Union Winter School on Space Phys., Part 2 1969 p 25 refs In RUSSIAN (See N71-38582 24-30)
Avail: NTIS

Chemical analysis of the moon's surface is discussed. Soils around lunar ring structures are considered. Chemical analysis is a possible aid in explaining the nature of infrared anomalies which are not observed in the visible formations of the lunar surface. Transl. by K.P.D.

N71-38590# Academy of Sciences (USSR), Moscow.
GEOPHYSICAL EFFECTS PRODUCED BY THE TUNGUSKA EXPLOSION OF 1908 c13
A. V. Zolotov *In its* Proc. of the 6th Ann. All-Union Winter

School on Space Phys., Part 2 1969 p 26-27 In RUSSIAN (See N71-38582 24-30)
Avail: NTIS

The explosion is believed to have been caused by either the action of the kinetic energy of a moving cosmic body or to the chemical or nuclear internal energy of the body. Radioactivity measurements were made on various types of trees in the Tunguska region. The geophysical effects are similar to those produced by a nuclear explosion. Transl. by K.P.D.

N71-38581# Academy of Sciences (USSR), Moscow.
A MODERN PICTURE OF THE ACCELERATION AND PROPAGATION OF SOLAR COSMIC RAYS c29
L. I. Miroshnichenko *In its* Proc. of the 6th Ann. All-Union Winter School on Space Phys., Part 2 1969 p 31-35 refs In RUSSIAN (See N71-38582 24-30)
Avail: NTIS

Direct measurement of solar protons was done in the low energy region of approximately 0.5-1 MeV. Direct measurements in interplanetary space yield information on the absolute stream of solar cosmic rays in a given energy interval. Cosmic ray spectra were studied for solar particles with energy equal to or greater than 500 MeV. An experiment was undertaken to determine the absolute (nonnormalized) value of m, the integral multiple of neutron generation, for neutron components. Interpretation of low energy (less than 100 MeV) solar proton spectra, measured near the earth's orbit, is complicated by possible proton acceleration in interplanetary space.
Transl. by K.P.D.

N71-38582# Academy of Sciences (USSR), Moscow.
THE COSMIC RAY ENERGY SPECTRUM IN INTERSTELLAR SPACE c29
A. N. Charakhchyan and T. N. Charakhchyan *In its* Proc. of the 6th Ann. All-Union Winter School on Space Phys., Part 2 1969 p 36-40 refs In RUSSIAN (See N71-38582 24-30)
Avail: NTIS

Intensity measurements were made for primary cosmic particles, and their relation to a number of sunspot groups is given. Values are extrapolated for four intervals of magnetic rigidity. The integral and differential proton energy spectra are presented for galactic cosmic rays. Transl. by K.P.D.

N71-38583# Academy of Sciences (USSR), Moscow.
THE COEFFICIENT OF DIFFUSION FOR COSMIC RAYS c29
A. N. Charakhchyan and T. N. Charakhchyan *In its* Proc. of the 6th Ann. All-Union Winter School on Space Phys., Part 2 1969 p 41-48 refs In RUSSIAN (See N71-38582 24-30)
Avail: NTIS

The dependence of the coefficient for solar cosmic rays on solar activity (number of sunspot groups) and on space coordinates is discussed. Proton coefficient values for the earth are given. The integral density spectrum of magnetic discontinuities is considered. Calculated values for coefficient modulation are given for variable galactic diffusion coefficients, as well as its dependence on sunspot numbers for primary particles. The energy spectrum of two-year variations and the density spectrum of magnetic discontinuities are also discussed. Transl. by K.P.D.

N71-38584# Academy of Sciences (USSR), Moscow.
DIFFUSION OF RELATIVISTIC ELECTRONS IN THE GALAXY AND THEIR ENERGY SPECTRUM c29
V. A. Dogel and S. I. Syrovatskiy *In its* Proc. of the 6th Ann. All-Union Winter School on Space Phys., Part 2 1969 p 49-51 refs In RUSSIAN (See N71-38582 24-30)
Avail: NTIS

The origin of cosmic rays is discussed. Sources are assumed to be ellipsoids in accordance with observed supernovae within the galaxy. Diffusion with a constant coefficient originates in unbounded space. Considering synchrotron, Compton, and catastrophic loss in a specific time interval, equations are given for electron density spectra. Data for galactic electron intensity near the earth are presented. Transl. by K.P.D.

N71-38585# Academy of Sciences (USSR), Moscow.
ULTRAHIGH ENERGY COSMIC RAYS c29
G. B. Kristiansen *In its* Proc. of the 6th Ann. All-Union Winter School on Space Phys., Part 2 1969 p 52-59 refs In RUSSIAN (See N71-38582 24-30)
Avail: NTIS

Charged particle streams and electromagnetic radiation, with energies greater than 10 to the 15th power eV, were observed. Particle shower spectra at sea level and at the tops of mountains were recorded. Upper limits for amplitude variation in primary ray intensity are given. A comparison is made of experimental and theoretical data on dispersion for variable particle numbers. Differential and integral cosmic ray spectra and equations for a nonstationary source are presented. Partial integral energy spectra for both stationary and nonstationary sources and total integral spectra for primary cosmic radiation agree with the proposed model. Transl. by K.P.D.

N71-38586# Academy of Sciences (USSR), Moscow.
TWENTY-SEVEN-DAY VARIATIONS OF COSMIC RAYS, BASED ON GROUND AND STRATOSPHERIC OBSERVATIONS, 1966-1967 c29
L. Kh. Shatashvili *In its* Proc. of the 6th Ann. All-Union Winter School on Space Phys., Part 2 1969 p 60-64 refs In RUSSIAN (See N71-38582 24-30)
Avail: NTIS

Azimuthal asymmetry of solar phenomena may cause an asymmetric solar wind with magnetic discontinuities and a 27-day cosmic ray modulation. Variation in the neutron component of cosmic rays, number of sunspots, and radiation intensity of the 5303 A line in the solar corona were recorded at several stations in the U.S.S.R. Resultant curves for maxima and minima of neutron intensity are presented. Transl. by K.P.D.

N71-38587# Academy of Sciences (USSR), Moscow.
MEASURING THE ANISOTROPY OF COSMIC RAYS DURING A SOLAR CYCLE c29
K. K. Fedchenko *In its* Proc. of the 6th Ann. All-Union Winter School on Space Phys., Part 2 1969 p 65-67 refs In RUSSIAN (See N71-38582 24-30)
Avail: NTIS

Neutron intensities measured at two Soviet stations during the 1958-1968 period were used. Anisotropic variations in the atmosphere and magnetic field are determined completely by solar wind anisotropy and depend on its velocity and the direction and structure of magnetic discontinuities. Amplitude variations and time of maxima in 24-hour variations during one solar cycle were determined. Particle amplitude distributions, 24-hour phases, and 12-hour variations for 1958 and 1964 are presented. Transl. by K.P.D.

N71-38588# Academy of Sciences (USSR), Moscow.
ELEVEN-YEAR MODULATION OF THE INTENSITY OF GALACTIC COSMIC RAYS AND THE HELIOGRAPHIC DISTRIBUTION OF SUNSPOTS c29
Yu. I. Stozhkov *In its* Proc. of the 6th Ann. All-Union Winter School on Space Phys., Part 2 1969 p 68-71 refs In RUSSIAN (See N71-38582 24-30)
Avail: NTIS

The influence of the 11-year solar cycle on cosmic rays is discussed. Curves of cosmic ray intensity versus number of sunspot groups occuring at the middle of the month are given. Data for cosmic ray intensities in the stratosphere are also presented. Transl. by K.P.D.

N71-38589# Academy of Sciences (USSR), Moscow.
MODULATION OF GALACTIC COSMIC RAYS c29
A. G. Zusmanovich, Ye. V. Kolomeyets, and Yu. A. Shakhova *In*

In proc. of the 6th Ann. All-Union Winter School on Space Phys., Part 2 1969 p 72-75 refs In RUSSIAN (See N71-38582 24-30)
Avail: NTIS

Energy distributions were measured for a wide range of particle energies. Differential spectra of protons and helium nuclei are presented. Intensity variations for cosmic rays and solar activity from 1964 to 1966 are given. Modulation functions are derived using a diffusion-convection model. Hysteresis dependence on the solar activity index is discussed, and correlation coefficients for midyear data are presented.

Transl. by K.P.D.

N71-38600# Academy of Sciences (USSR), Moscow.
THE TWENTY-SEVEN-DAY VARIATIONS IN COSMIC RAY INTENSITY AND SOLAR ACTIVITY IN THE PERIOD 1958-1967 c29
V. P. Okhlopov *In its* Proc. of the 6th Ann. All-Union Winter School on Space Phys., Part 2 1969 p 76 In RUSSIAN (See N71-38582 24-30)
Avail: NTIS

Amplitude variation in Wolf number was 45%. Longitude asymmetry varied by 40%, indicating cosmic ray dependence on sunspot activity.

Transl. by K.P.D.

N71-38601# Academy of Sciences (USSR), Moscow.
FLUCTUATIONS OF GALACTIC COSMIC RAYS OF INTERPLANETARY ORIGIN c29
V. I. Shishov *In its* Proc. of the 6th Ann. All-Union Winter School on Space Phys., Part 2 1969 p 77 In RUSSIAN (See N71-38582 24-30)
Avail: NTIS

Fluctuations are due to particle scattering in discontinuities in the interplanetary magnetic field. The dimensions of the discontinuities must be less than the gyroradius of the particles. These fluctuations can be used to study magnetic field structure.

Transl. by K.P.D.

N71-38602# Academy of Sciences (USSR), Moscow.
THE BAROMETRIC COEFFICIENT OF THE NEUTRON COMPONENT OF COSMIC RAY INTENSITY AND CALCULATION OF THE EFFECTS OF PROTON AND MU MESON ABSORPTION c29
M. V. Alaniya and O. G. Rogava *In its* Proc. of the 6th Ann. All-Union Winter School on Space Phys., part 2 1969 p 78 ref In RUSSIAN (See N71-38582 24-30)
Avail: NTIS

An equation for the barometric coefficient is presented. Magnitude of coefficient distortion is calculated.

Transl. by K.P.D.

N71-38603# Academy of Sciences (USSR), Moscow.
EVALUATIONS OF THE PARTIAL BAROMETRIC COEFFICIENT OF INTEGRAL MULTIPLES FOR THE NEUTRON COMPONENT OF SECONDARY COSMIC RADIATION c29
L. I. Dorman and A. V. Sergeyev *In its* Proc. of the 6th Ann. All-Union Winter School on Space Phys., part 2 1969 p 79-80 refs In RUSSIAN (See N71-38582 24-30)
Avail: NTIS

An empirical formula is derived for partial coefficient calculation and coefficient values are presented.

Transl. by K.P.D.

N71-38604# Academy of Sciences (USSR), Moscow.
COMPARATIVE ANALYSIS OF VARIOUS MODELS OF THE GEOMAGNETIC FIELD c13
V. A. Shakov and V. P. Nikitin *In its* Proc. of the 6th Ann. All-Union Winter School on Space Phys., part 2 1969 p 81 In RUSSIAN (See N71-38582 24-30)
Avail: NTIS

Comparison of magnetic field models with a Gaussian sequence indicates that for small heights a Gaussian sequence can be used for a sufficiently large number of terms.

Transl. by K.P.D.

N71-38605# Academy of Sciences (USSR), Moscow.
METEORIC VARIATION OF COSMIC RAY INTENSITY IN THE NEIGHBORHOOD OF A NEW MAXIMUM IN SOLAR ACTIVITY, 1957-1958 c29
S. A. Belskiy *In its* Proc. of the 6th Ann. All-Union Winter School on Space Phys., part 2 1969 p 82 In RUSSIAN (See N71-38582 24-30)
Avail: NTIS

It is concluded that many case of Forbush-type decreases and of increase in the minimum Forbush-type decrease are a manifestation of the effect of variation of cosmic rays coming from different meteor streams.

Transl. by K.P.D.

N71-38606# Academy of Sciences (USSR), Moscow.
STATISTICAL ANALYSIS OF HYPOTHESES c19
Yu. I. Sorokhtin *In its* Proc. of the 6th Ann. All-Union Winter School on Space Phys., part 2 1969 p 85-106 refs In RUSSIAN (See N71-38582 24-30)
Avail: NTIS

Basic statistical definitions and terminology are given. A general approach to statistical analysis is presented. Nonparametric criteria are derived and considered. The application of criteria to the analysis of normal random distributions is discussed.

Transl. by K.P.D.

N71-38607# Academy of Sciences (USSR), Moscow.
ANALYSIS OF LATENT PERIODICITIES AND THE POSSIBILITY OF STATISTICAL PREDICTION c19
O. B. Vasilyev *In its* Proc. of the 6th Ann. All-Union Winter School on Space Phys., part 2 1969 p 107-114 refs In RUSSIAN (See N71-38582 24-30)
Avail: NTIS

Analysis of Dirichlet functions and discrete function spectra is considered. Methods discussed are harmonic and quasiharmonic analysis, correlation analysis, and operator analysis. Evaluation of the narrow structure of bright-line spectra is also considered.

Transl. by K.P.D.

N71-38608# Academy of Sciences (USSR), Moscow.
A RAPID FOURIER TRANSFORMATION c19
K. A. Kandaurova *In its* Proc. of the 6th Ann. All-Union Winter School on Space Phys., part 2 1969 p 114 refs In RUSSIAN (See N71-38582 24-30)
Avail: NTIS

The Monte Carlo method is applied to the Fourier integral in the analysis of discontinuous periodic functions.

Transl. by K.P.D.

N71-38609# Academy of Sciences (USSR), Moscow.
ONE OF THE CRITERIA FOR QUALITY CONTROL OF A NEUTRON SUPERMONITOR c14
Ya. L. Blokh and I. N. Kapustin *In its* Proc. of the 6th Ann. All-Union Winter School on Space Phys., part 2 1969 p 115-116 refs In RUSSIAN (See N71-38582 24-30)
Avail: NTIS

Choice of signal characteristic ratio with respect to an ideal apparatus is considered. An equation is derived for the maximum possible quality coefficient for a given supermonitor.

Transl. by K.P.D.

N71-38610# Academy of Sciences (USSR), Moscow.
ADJUSTMENT OF MULTIPLE DATA RECORDERS USING A MATHEMATICAL DEVICE c29
I. N. Kapustin *In its* Proc. of the 6th Ann. All-Union Winter School on Space Phys., part 2 1969 p 117-122 refs In RUSSIAN (See N71-38582 24-30)

Avail: NTIS

Equations for calculating coincidence effect are derived for application to the analysis of the neutron component intensity for cosmic rays. It is assumed that primary particle streams responsible for differences in multiplicity are independent and that each stream has a Poisson distribution in time.

Transl. by K.P.D.

N71-38611# Academy of Sciences (USSR), Moscow.
THE EFFECT OF COINCIDENCES DURING MULTIPLE RECORDING OF THE NEUTRON COMPONENT OF COSMIC RAYS c29

I. N. Kapustin and V. A. Radkevich *In its* Proc. of the 6th Ann. All-Union Winter School on Space Phys., part 2 1969 p 123-124 refs In RUSSIAN (See N71-38582 24-30)

Avail: NTIS

Data indicate that a significant part of the increase in the barometric coefficient may be explained by the coincidence effect. Use of the method of automatic exclusion of this effect obviates the need for different corrections for various neutron monitor types.

Transl. by K.P.D.

N71-38612# Academy of Sciences (USSR), Moscow.
MACHINE PROCESSING OF COSMIC RAY STATION DATA c29

V. S. Smirnov and V. G. Ustinovich *In its* Proc. of the 6th Ann. All-Union Winter School on Space Phys., part 2 1969 p 125 In RUSSIAN (See N71-38582 24-30)

Avail: NTIS

A block diagram is proposed for daily data evaluation. Data are assumed to have a Poisson distribution.

Transl. by K.P.D.

N71-38613# Academy of Sciences (USSR), Moscow.
EQUIPMENT FOR MEASURING THE RETARDATION OF X-RADIATION IN THE STRATOSPHERE IN THE ZONE OF THE POLAR GLOW c13

I. A. Kuzmin *In its* Proc. of the 6th Ann. All-Union Winter School on Space Phys., part 2 1969 p 126-127 refs In RUSSIAN (See N71-38582 24-30)

Avail: NTIS

Electron emission was studied using rocket and satellite observations, as well as indirect analyses of polar glow, variations in the magnetic field and X-radiation, and rheometers. Principles of telemetry systems are discussed.

Transl. by K.P.D.

N71-38614# Academy of Sciences (USSR), Moscow.
AN ARRANGEMENT FOR OBTAINING THE FIVE-MINUTE VALUE FOR COSMIC RAY INTENSITY c29

L. A. Sharovalova and V. I. Tergoyev *In* Its Proc. of the 6th Ann. All-Union Winter School on Space Phys., part 2 1969 p 128 In RUSSIAN (See N71-38582 24-30)

Avail: NTIS

A 42-channel automatic recording system was used to study neutron component intensity and 15-minute values of atmospheric pressure. The method is described.

Transl. by K.P.D.

N71-38615# Academy of Sciences (USSR), Moscow.
OPERATIONAL DATA FOR THE IRKUTSK COSMIC RAY STATION c14

M. A. Kovalenko and L. A. Shapovalova *In its* Proc. of the 6th Ann. All-Union Winter School on Space Phys., part 2 1969 p 129 In RUSSIAN (See N71-38582 24-30)

Avail: NTIS

Station equipment includes three sections of neutron supermonitors, four azimuth telescopes of cubic geometry, a 42-channel automatic recording system, and auxiliary recording instruments. Data are given for speed correlation values for two supermonitor sections during the period May 1968 - Jan. 1969.

Transl. by K.P.D.

N71-38616# Academy of Sciences (USSR), Moscow.
ONE POSSIBILITY FOR APPROXIMATING A CURVED LATITUDINAL PATH c18

A. S. Inchin, A. Manshalina, Yu. I. Okulov, and I. A. Pimenov *In its* Proc. of the 6th Ann. All-Union Winter School on Space Phys., part 2 1969 p 130-132 refs In RUSSIAN (See N71-38582 24-30)

Avail: NTIS

Interpolated Lagrange polynomials are used for a two-stage curve approximation. Accuracy of approximation is greater than with the least squares method.

Transl. by K.P.D.

N71-38617# Academy of Sciences (USSR), Moscow.
SPARK CHAMBERS c11

Ye. A. Damaskinskiy *In its* Proc. of the 6th Ann. All-Union Winter School on Space Phys., part 2 1969 p 133-141 refs In RUSSIAN (See N71-38582 24-30)

Avail: NTIS

Types of nuclear track instruments are discussed. Principles, efficiency, and time properties of spark chambers are considered. Impulse measurement and particle energies are also discussed.

Transl. by K.P.D.

N71-38618# Academy of Sciences (USSR), Moscow.
A HEAVY-LIQUID BUBBLE CHAMBER FOR COSMIC RESEARCH c14

L. V. Bekonov, K. N. Yermakov, B. D. Lebedyev, A. V. Monakhov, V. I. Rozum et al *In its* Proc. of the 6th Ann. All-Union Winter School on Space Phys., part 2 1969 p 142-146 refs In RUSSIAN (See N71-38582 24-30)

Avail: NTIS

Particle identification with bubble chambers is discussed. A model of an autonomous chamber is described. The model is a variation of instruments now used in space physics. It can be used for determining the angular distribution of ionized particles, their spectra over a wide energy range, their radiation structure, and their space-time characteristics.

Transl. by K.P.D.

N71-38619# Academy of Sciences (USSR), Moscow.
MATERIALS FOR THE OPTICAL SYSTEMS OF CERENKOV AND SCINTILLATION COUNTERS c14

V. S. Chukin *In its* Proc. of the 6th Ann. All-Union Winter School on Space Phys., part 2 1969 p 147-148 refs In RUSSIAN (See N71-38582 24-30)

Avail: NTIS

Processes operating within the optical systems are considered. Spectral and optical characteristics of the counters are given.

Transl. by K.P.D.

N71-38620# Academy of Sciences (USSR), Moscow.
POSSIBILITY FOR DETERMINING THE DIRECTION AND POLARIZATION OF GAMMA QUANTA BASED ON TWO SUCCESSIVE OCCURRENCES OF COMPTON SCATTERING IN DETECTOR MATERIAL c29

G. M. Gorodinskiy and Ye. M. Kruglov *In its* Proc. of the 6th Ann. All-Union Winter School on Space Phys., part 2 1969 p 149-150 refs In RUSSIAN (See N71-38582 24-30)

Avail: NTIS

A method is presented for astrophysical localization of gamma sources in the energy range 1-50 MeV. Ratios of scattered quanta to electrons are given. The luminescence camera, assembled from scintillation filaments, was sensitive to linear polarization of primary quanta.

Transl. by K.P.D.

N71-38621# Academy of Sciences (USSR), Moscow.
A FIVE-CHANNEL WEAK-SIGNAL ANALYZER c14

V. V. Petrov *In its* Proc. of the 6th Ann. All-Union Winter School on Space Phys., part 2 1969 p 151-154 refs In RUSSIAN (See N71-38582 24-30)

Avail: NTIS

An instrument used for measuring very small quantities of

radioactive gases is described. Equations for stability and drift are derived. Transl. by K.P.D.

N71-38622# Academy of Sciences (USSR), Moscow.
METHOD OF DETERMINING PARAMETERS OF AMPLITUDE DISCRIMINATORS IN TUNNEL DIODES c09
V. S. Yeletskiy *In its* Proc. of the 6th Ann. All-Union Winter School on Space Phys., part 2 1969 p 155 In RUSSIAN (See N71-38582 24-30)
Avail: NTIS

Equations are derived for temperature drift and peak current degradation in tunnel diodes. Transl. by K.P.D.

N71-38623# Academy of Sciences (USSR), Moscow.
FOSVICH-TYPE SCINTILLATION DETECTORS OF FAST NEUTRONS c14
V. V. Yuryev, A. M. Romenov, and Ye. V. Myskinin *In its* Proc. of the 6th Ann. All-Union Winter School on Space Phys., part 2 1969 p 156 In RUSSIAN (See N71-38582 24-30)
Avail: NTIS

Instruments are described for measuring streams and spectra of 1-10 MeV neutrons in the upper layers of the atmosphere and beyond. Counters with internal liquids and with organic crystals are considered Transl. by K.P.D.

N71-38624# Academy of Sciences (USSR), Moscow.
A MULTICHANNEL GAMMA SPECTROMETER FOR COSMIC RESEARCH c14
S. V. Golenetskiy, V. I. Ilinskiy, R. L. Aptekar, Yu. A. Guryan, Ye. P. Mazets et al *In its* Proc. of the 6th Ann. All-Union Winter School on Space Phys., part 2 1969 p 157 In RUSSIAN (See N71-38582 24-30)
Avail: NTIS

An instrument is described for gamma ray detection in the energy region of 0.3-2.5 MeV. Its use allows for the separation of gamma radiation from the charged particle background. Transl. by K.P.D.

N71-38625# Academy of Sciences (USSR), Moscow.
THE RADIOCARBON METHOD OF DETERMINING ABSOLUTE AGE c24
R. S. Zavelskiy *In its* Proc. of the 6th Ann. All-Union Winter School on Space Phys., part 2 1969 p 158-163 refs In RUSSIAN (See N71-38582 24-30)
Avail: NTIS

A radiocarbon detector involving a grid-wall Geiger counter is described. The principles, precision, and limitations of the method are discussed. The method establishes principal upper age limit. Transl. by K.P.D.

N71-38626# National Research Council of Canada, Ottawa (Ontario).
QUARTERLY BULLETIN OF THE DIVISION OF MECHANICAL ENGINEERING AND THE NATIONAL AERONAUTICAL ESTABLISHMENT, 1 APRIL - 30 JUNE 1971
Jun. 1971 113 p refs
(DME/NAE-1971(2)) Avail: NTIS

CONTENTS:
1. LOW SPEED AERODYNAMICS AND THE SCIENCE COUNCIL'S NATIONAL GOALS R. J. Templin (Natl. Aeron. Estab., Ottawa, Ontario) p 1-20 refs (See N71-38627 24-01)
2. EXPERIMENTS WITH AN ON-LINE PICTURE LANGUAGE T. Kasvand p 21-56 refs (See N71-38628 24-06)
3. THE UNBOUNDED TURBULENT JET AS A TRANSDUCER ELEMENT J. W. Tenney (Natl. Aeron. Estab., Ottawa, Ontario) p 57-87 refs (See N71-38629 24-14)
4. CURRENT PROJECTS p 89-111

N71-38627# National Aeronautical Establishment, Ottawa (Ontario). Low Speed Aerodynamics Lab.
LOW SPEED AERODYNAMICS AND THE SCIENCE COUNCIL'S NATIONAL GOALS c01
R. J. Templin *In* NRC of Can. Quart. Bull. of the Div. of Mech. Eng. and the Natl. Aeron. Estab., 1 Apr. - 30 Jun. 1971 Jun. 1971 p 1-20 refs (See N71-38626 24-30)
Avail: NTIS

A simple version of the so-called relevance tree forecasting method was used to relate the Science Council's list of National Goals to relevant research gaps in low speed aerodynamics. The exercise was performed mainly out of curiosity, partly as to the nature of the method itself, and partly as to the results it can produce. The numerical results of the relevance marking system used appear to be sensitive to individual judgment, and may merely indicate which bandwagon the scorer prefers. On the other hand, the relevance tree provides a simple graphic display of the possible connections between specific research areas, and broad national goals. Author

N71-38628# National Research Council of Canada, Ottawa (Ontario). Control Systems Lab.
EXPERIMENTS WITH AN ON-LINE PICTURE LANGUAGE c08
T. Kasvand *In its* Quart. Bull. of the Div. of Mech. Eng. and the Natl. Aeron. Estab., 1 Apr. - 30 Jun. 1971 Jun. 1971 p 21-56 refs (See N71-38626 24-30)
Avail: NTIS

Some of the problems encountered in trying to realize a machine system that solves diverse pattern recognition problems is discussed. The proposed solutions were tested to a degree by using an on-line picture language or program. A preliminary version of the picture program was completed. By using a controllable flying spot scanner, the computer has direct access to a picture of about 4,000 x 4,000 resolution elements. The picture is treated as a read only memory and it may contain many different objects. Author

N71-38629# National Aeronautical Establishment, Ottawa (Ontario). Low Speed Aerodynamics Lab.
THE UNBOUNDED TURBULENT JET AS A TRANSDUCER ELEMENT c14
J. W. Tenney *In* NRC of Can. Quart. Bull. of the Div. of Mech. Eng. and the Natl. Aeron. Estab., 1 Apr. - 30 Jun. 1971 Jun. 1971 p 57-87 refs (See N71-38626 24-30)
Avail: NTIS

Three different fluidic sensors that use a turbulent jet as the transducing element are described. The output of these devices, which measure either ambient velocity of density, is obtained by pressure measurements within the jet. A theory of operation and calibration results are presented for a number of fluidic velocity sensors that use a jet normal to the measured flow. Co-flowing sensors having the jet parallel to the measured flow are described and experimental data are presented. The development of the co-flowing concept into a three-axis sensor is illustrated. A fluidic densitometer is described. Author

N71-38630# Rosenstiel School of Marine and Atmospheric Sciences, Miami, Fla.
STUDIES ON METEORITES Final Report, 1 Oct. 1968 - 30 Sep. 1970
David E. Fisher Feb. 1971 9 p
(Contract AT(40-1)-3585)
(ORO-3585-22; ML-71016) Avail: NTIS

Several aspects of meteoritic research were investigated during the contract years. Particular results are briefly summarized. Geochemical investigations carried out are briefly described. A list of papers resulting from the contract is included. NSA

N71-38631# Atomic Energy Commission, Oak Ridge, Tenn. Technical Information Div.
PULSARS BIBLIOGRAPHY

William D. Matheny May 1971 64 p
(TID-3320-Suppl-1) Avail: NTIS

A bibliography on pulsars, neutron stars, black holes, supernova remnants, and cosmic X-ray sources is presented. The literature of 1970 consists of 380 abstracts taken from Nuclear Science Abstracts. Author and subject indexes are included.
Author (NSA)

N71-38632# Oslo Univ. (Norway).
CHEMICAL COMPOSITION OF THE SOLAR ATMOSPHERE
Oe. Hauge and O. Engvold 1970 29 p refs
(NP-18857; Rept-31) Avail: AEC Depository Libraries

The present working values for the solar abundance of chemical elements are listed. The solar abundance of 65 chemical elements is known. The abundance of some elements determined from the photospheric spectrum is based on one line only (Ge,Ge,Sn,Er,Yb,Lu,Au, and Th) and the results may be erroneous. For seven elements (B,Rh,Cs,Hg,Tl,Bi,and U) only upper limits are given for the abundances. Lines of Ho and Tb are suspected in the solar photospheric spectrum, but the abundances of these elements are not determined. For 21 chemical elements with atomic number less than 38, the solar abundances are derived by two or more different methods. A separate list is made for solar isotope ratios of eight elements that have been investigated. Author (NSA)

N71-38633# Naval Research Lab., Washington, D.C.
REPORT OF NRL PROGRESS SEPTEMBER 1971
Sep. 1971 46 p refs
Avail: NTIS

Two experimental investigations are described and the results obtained are presented. One study involved the determination of lithium fluoride glow-peak growth due to annealing. The other study consisted of analyzing the performance, at audio frequencies, of a half-wave rectifying circuit with a theoretical efficiency of 100 percent. D.L.G.

N71-38634# Naval Research Lab., Washington, D.C. Solid State Technology Branch.
EXPERIMENTAL STUDY AT AUDIO FREQUENCIES OF A HALF-WAVE RECTIFYING CIRCUIT WITH A THEORETICAL EFFICIENCY OF 100 PERCENT c10
W. C. Jenkins *In its* Rept. of NRL Progress, Sep. 1971 Sep. 1971 p 1-4 refs (See N71-38633 24-30)
Avail: NTIS

To obtain a better understanding of the operation of a microwave rectifier, the low-frequency analog of a half-wave microwave rectification circuit with a theoretical rectification efficiency of 100 percent was constructed and tested. The losses which prevent the circuit from achieving its theoretical efficiency were identified and measured. The laboratory circuit was found to have a rectification efficiency of 84 percent. Nine percent of the available power was lost in the filter network due to nonideal components. Seven percent of the available power was dissipated by the forward resistance of the diode. Author

N71-38635# Naval Research Lab., Washington, D.C.
LITHIUM FLUORIDE GLOW-PEAK GROWTH DUE TO ANNEALING c08
L. F. Booth, T. L. Johnson, and F. H. Attix *In its* Rept. of NRL Progress, Sep. 1971 Sep. 1971 p 5-12 refs Supported in part by AEC (See N71-38633 24-30)
Avail: NTIS

The heights of the LiF thermoluminescent glow peaks in the vicinity of 200 C, usually employed for dosimetry, display a marked growth as a function of storage time occurring either before or after a given gamma ray exposure. The magnitude of the effect depends on the population of low-temperature traps present, and on the readout heating-rate employed. The dosimetry error caused by this sensitivity increase was reduced to negligible levels through the use of a routine prereadout annealing treatment of 15 minutes at 100 C. No additional annealing procedure was found to be necessary for LiF, so long as the gamma ray exposures were not large enough to cause radiation-induced sensitization of the phosphor. Author

N71-38636# Air Force Cambridge Research Labs., Bedford, Mass.
GEOPHYSICS AND SPACE DATA BULLETIN. VOLUME 8, NO. 1. FIRST QUARTER 1971
Anne L. Carrigan 1971 360 p refs
(AD-727778; AFCRL-71-0339; AFCRL-SR-119) Avail: NTIS CSCL 03/2

The Bulletin is a quarterly publication that contains AFCRL contract and inhouse data reported from sites throughout the world. The following types of data are contained within each issue: magnetometer, cosmic ray, ELF noise, riometer, solar optical and radio emission, and ionosonde. This issue covers such data for January, February, and March 1971.
Author (GRA)

N71-38637# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE MOTION AND VAPORIZATION OF PRODUCTS OF THE FRAGMENTATION OF METEOR BODIES
V. A. Vorobeva 23 Apr. 1971 18 p refs Transl. into ENGLISH from Komety i Meteory (USSR), no. 16, 1969 p 11-19
(AD-727430; FTD-HT-23-131-71) Avail: NTIS CSCL 04/1

A study is given of the motion and vaporization of meteor fragments on the basis of photographs obtained at the Odessa observatory. An attempt is made to apply the theory of permanent fragmentation of particles to bright meteors. The equation of motion is solved by numerical integration. Changes in velocity, mass, and retardation of the fragments with respect to the parent body are calculated on a computer. It is shown that the formation of wakes of bright meteor bodies can be interpreted in terms of permanent particle fragmentation only for slow meteors, assuming that they fragmentize into relatively large particles. Author (GRA)

N71-38638# Aerospace Corp., El Segundo, Calif.
TRACE 66 TRAJECTORY ANALYSIS AND ORBIT DETERMINATION PROGRAM. VOLUME 7: USAGE GUIDE
W. D. Downs, R. J. Mercer, Robert H. Pristin, A. J. Riekk, and D. C. Walker 30 Jun. 1971 554 p refs
(Contract F04701-70-C-0069)
(AD-727752; TR-0069(9320)-1-Vol-7; SAMSO-TR-71-141-Vol-7) Avail: NTIS CSCL 22/3

The TRACE 66 Orbit Determination Program is a general-purpose orbital analysis program. It was written specifically for the CDC 6000 series computers to assist The Aerospace Corporation personnel in the analysis and design of satellite orbits and tracking systems. Volume 7 is intended to serve as an input usage guide, which defines all input required to perform TRACE 66 functions such as trajectory generation, data/observation generation, orbit determination, and statistical analysis. A comprehensive description for each specific input item is given and input data deck structures are shown.
Author (GRA)

N71-38639*# Wichita State Univ., Kans.
PREDICTIONS ON THE CHARACTERISTICS OF THE MINIMAL TWO-IMPULSE ORBITAL TRANSFER UNDER ARBITRARY TERMINAL CONDITIONS BY USING THE BOUNDING TRAJECTORIES
Fang Toh Sun Washington NASA Oct. 1971 111 p refs
(Grant NGR-17-003-008)
(NASA-CR-1822) Avail: NTIS CSCL 22B

The terminal conditions are assumed arbitrary. The concept of bounding trajectories is applied, from which qualitative and quantitative information on the minimal total impulse transfer are deduced without solving the equation, governing the optimal

transfer. To verify the predictions, numerical examples are presented. Author

N71-38640# National Inst. for Telecommunications Research, Hartebeesthoek (South Africa). Deep Space Instrumentation Facility.
MARINER 9 MISSION Summary Report, 19 Jun. - 30 Sep. 1971
H. M. Bryant 18 Oct. 1971 11 p refs
(DSIF-51/OP-S) Avail: NTIS

A summary of the schedule tracking operations between passes 20 and 123 for the Mariner 9 is given. Data are also included for operational vertification tests and the performance of equipment. E.H.W.

N71-38641# Royal Greenwich Observatory, Herstmonceux (England).
GREENWICH TIME REPORT, OCTOBER - DECEMBER 1970
Dec. 1970 19 p
Avail: NTIS

Results of Greenwich time and lattitude observations for the period October through December, 1970 are presented. Also included are radio time signals and standard frequency emissions. Author

N71-38642# Joint Publications Research Service, Washington, D.C.
TWENTY-SECOND INTERNATIONAL ASTRONAUTICAL CONGRESS
28 Oct. 1971 50 p refs Transl. into ENGLISH from Russian reports Congr. held at Brussels, 20-26 Sep. 1971
(JPRS-54340) Avail: NTIS

CONTENTS:

1. TEN YEARS IN SPACE B. B. Yegorov p 1-5 (See N71-38643 24-30)
2. STUDY OF TRACE CONTAMINANTS IN MAN-EXHALED AIR Yu. G. Nefjodov et al p 6-10 (See N71-38644 24-04)
3. PROMISING METHODS FOR WATER RECLAMATION IN SPACECRAFT LIFE SUPPORT SYSTEMS S. V. Chizhov et al p 11-18 (See N71-38645 24-05)
4. POSSIBLE METHODS FOR APPRAISING RELIABILITY OF LONG-LIVED LIFE SUPPORT SYSTEMS B. A. Adamovich et al p 19-36 (See N71-38646 24-05)
5. QUALITY EVALUATION OF ERGATIC PROCESSES IN SPACE VEHICLE CONTROL A. D. Korotkov et al p 37-43 (See N71-38647 24-05)
6. PSYCHOLOGICAL ASPECTS OF ADAPTIVE BEHAVIOR IN COMPLEX SPATIAL ENVIRONMENTS V. I. Myasnikov et al p 44-48 (See N71-38648 24-05)

N71-38643# Joint Publications Research Service, Washington, D.C.
TEN YEARS IN SPACE
B. B. Yegorov *In its* 22d Intern. Astronautical Congr. 28 Oct. 1971 p 1-5 (See N71-38642 24-30)
Avail: NTIS

A tribute to the pioneers in space exploration is presented along with expectations for future flights. The impact of Cosmonaut Gagarin's first around-the-world flight is described, and Astronaut Armstrong's footprints and Lunokhod I's tracks on the moon are also mentioned as landmarks. The benefits to mankind of space technology are briefly reviewed and it is felt particularly desirable to apply the experience obtained by automatic processing of physiological information used in space flight to the public health field. N.E.N.

N71-38644# Joint Publications Research Service, Washington, D.C.
STUDY OF TRACE CONTAMINANTS IN MAN-EXHALED AIR c04
Yu. G. Nefjodov et al *In its* 22d Intern. Astronautical Congr. 28 Oct. 1971 p 6-10 (See N71-38642 24-30)
Avail: NTIS

The gas chromatography method was used together with other techniques to identify and measure trace contaminants in man-exhaled air. The air exhaled by the test subjects contained a large number of trace contaminants. They included the following toxic compounds: methanol, ethanol, acetaldehyde, acetone, methyl ethyl ketone, and amines. Investigations of man-exhaled air were made during chamber experiments, which included stress factors inherent in space missions, e.g. hypodynamia, starvation, increased temperature and humidity. The experiments demonstrated a correlation between the amount of contaminants exhaled and the effect of the stress factors. Hunger and high temperatures produced a particular effect on the qualitative and quantitative composition of the toxic compounds. Author

N71-38645# Joint Publications Research Service, Washington, D.C.
PROMISING METHODS FOR WATER RECLAMATION IN SPACECRAFT LIFE SUPPORT SYSTEMS c05
S. V. Chizhov et al *In its* 22d Intern. Astronautical Congr. 28 Oct. 1971 p 11-18 (See N71-38642 24-30)
Avail: NTIS

An analysis of the sources of water-bearing wastes, mass flows, and their chemical composition demonstrates that most of the water can be reclaimed using the sorption technique. The technique can also be applied to the atmospheric condensate, transpiration water of higher and lower plants, water produced by electrochemical generators, condensates resulting from catalytic decomposition of hydrogen peroxide, and catalytic hydration of carbon dioxide. The problem of water regeneration from urine and wash water can be solved by evaporation in the air stream and catalytic oxidation of volatile admixtures. This method is also advantageous due to a relatively low weight of the regenerative system, a high quality of the regenerated water, and large quantity of recycled water. Author

N71-38646# Joint Publications Research Service, Washington, D.C.
POSSIBLE METHODS FOR APPRAISING RELIABILITY OF LONG LIVED LIFE SUPPORT SYSTEMS c05
B. A. Adamovich et al *In its* 22d Intern. Astronautical Congr. 28 Oct. 1971 p 19-36 refs (See N71-38642 24-30)
Avail: NTIS

Methods of reliability data acquisition from ground and orbital experiments during which the crew provides maintenance of the system are described. The possibility of applying accelerated tests for life support systems and for independent studies of system components is discussed. A generalized model of reliability is developed, and the necessity of complex ground-based experiments on life support systems is stressed. N.E.N.

N71-38647# Joint Publications Research Service, Washington, D.C.
QUALITY EVALUATION OF ERGATIC PROCESSES IN SPACE VEHICLE CONTROL c05
A. D. Korotkov et al *In its* 22d Intern. Astronautical Congr. 28 Oct. 1971 p 37-43 (See N71-38642 24-30)
Avail: NTIS

A method is proposed for evaluating the work capacity of a human operator based on probability-iterative methods and the mathematical theory of linear differential transforms. The method takes into account human adaptability in the course of professional training and makes it possible to determine the probability of successful implementation of a task in the course of one control cycle under both nominal and emergency flight conditions. The high information yield of this method is supported by a number of experiments. Author

N71-38648# Joint Publications Research Service, Washington, D.C.
PSYCHOLOGICAL ASPECTS OF ADAPTIVE BEHAVIOR IN COMPLEX SPATIAL ENVIRONMENTS c05
V. I. Myasnikov et al *In its* 22d Intern. Astronautical Congr. 28 Oct. 1971 p 44-48 (See N71-38642 24-30)
Avail: NTIS

An experiment is described for determining the possibility of observing man's spatial activity under psychologically difficult conditions of a modified postural-motor regime. Inexperienced volunteers and experienced divers and parachutists, 21 to 35 years old, stood on platforms of limited area 18 and 10 m above ground. The subjects attempted to maintain a vertical position on the platform while retaining and excluding visual control, and maintaining an equilibrium body position during turning and moving of the support. The motions and sensations of those subjects having difficulty maintaining erect posture are described, and three variants are defined. N.E.N.

N71-38649# Joint Publications Research Service, Washington, D.C.
SOVIET-BLOC RESEARCH IN GEOPHYSICS, ASTRONOMY, AND SPACE, NO. 260
13 Sep. 1971 67 p Transl. into ENGLISH from Russian reports
(JPRS-54039) Avail: NTIS

Materials from recent publications of the Sino-Soviet Bloc countries are presented in the form of abstracts, summaries, and occasionally full articles. The topics covered are astronomy, meteorology, oceanography, geology, upper atmosphere, and space research. Author

N71-38650# Joint Publications Research Service, Washington, D.C.
SOVIET-BLOC RESEARCH IN GEOPHYSICS, ASTRONOMY, AND SPACE, NO. 262
14 Oct. 1971 50 p refs Transl. into ENGLISH from Russian reports
(JPRS-54246) Avail: NTIS

Materials from recent publications of the Sino-Soviet Bloc countries are presented in the form of abstracts, summaries, and occasionally full articles. The topics covered are astronomy, meteorology, oceanography, geology, upper atmosphere, and space research. Author

N71-38651# National Oceanic and Atmospheric Administration, Washington, D.C.
SPACE: ENVIRONMENTAL VANTAGE POINT
1971 40 p Original contains color illustrations
(NOAA/PI-70033) Avail: SOD $0.70 CSCL 22C

The use of satellites in meteorological research and weather forecasting is treated from the first Tiros 1, launched in 1960, through projected 1970's missions. The type of remote sensing and photographing the satellites do, their trajectories and instruments, and the data processing are briefly described. Illustrative cloud photographs are included. The satellites mentioned are Tiros, Nimbus, TOS, ITOS, ESSA, ATS, and GOES. N.E.N.

N71-38652* National Aeronautics and Space Administration, Washington, D.C.
MARINER 9: PRESS KIT
Richard T. Mittauer 22 Oct. 1971 19 p
(NASA-News-Release-71-215) Avail: NASA Scientific and Technical Information Facility, P. O. Box 33, College Park, Md. 20740 CSCL 22C

The Mariner 9 Mars mission is reported. Topics discussed include the pre-encounter phase, and orbital operations. A Mars fact sheet, and a schedule of November events for the flight are included. F.O.S.

N71-38653 Royal Observatory, Edinburgh (Scotland).
PHOTOGRAPHIC V AND R MAGNITUDES OF T TAURI STARS AND RELATED OBJECTS IN ORION
M. T. Brueck (Edinburgh Univ.) 1971 15 p refs *Its* Publ. of the Roy. Obs., 1971, v. 7, no. 5
Copyright. Avail: Issuing Activity

Photographic V and R magnitudes are given for 67 T Tauri, flare and H alpha emission stars in the Orion nebula region. Three additional possible T Tauri stars are identified on the basis of color excesses. Details of variability are given for 15 stars. It is suggested that T Tauri and related stars are intrinsically more reddened than the generality of stars in the association. Author

31 SPACE VEHICLES

Includes launch vehicles; manned space capsules; clustered and multistage rockets; satellites; sounding rockets and probes; and operating problems. For basic research see: 30 Space Sciences. For related information see also: 28 Propulsion Systems; and 32 Structural Mechanics.

N71-38654*# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
UNSTEADY AERODYNAMIC LOADS DURING REENTRY OF THE STRAIGHT-WING ORBITER CONFIGURATION Final Report
Hanno H. Heller and D. Graham Holmes [1971] 102 p refs (Contract NAS1-9559)
(NASA-CR-111960; Rept-2116) Avail: NTIS CSCL 22C

A wind tunnel study was conducted to determine overall levels and spectra of the pressure fluctuations acting on the leeward side of the straight-wing space shuttle orbiter configuration during reentry. Scaled models (1:250 and 1:126) at 60 deg attitude were exposed to free-stream flow speeds corresponding to Mach numbers of 4 and 2.5. Tests on these orbiter models were supplemented by a study of pressure fluctuations on an 8 deg half-angle cone/flat-base configuration at free-stream Mach numbers of 4, 2.5, and 0.67. The results of these studies, and comparison with data available in the open literature, suggest that, at free-stream Mach numbers of 4 and 2.5, the values of the overall pressure-coefficient are 0.03 nearly everywhere on the leeward side of the fuselage, and are about 0.1 in areas affected by wing wakes and wing shocks. Author

N71-38655*# McDonnell-Douglas Astronautics Co., St. Louis, Mo.
SPACE SHUTTLE AUXILIARY PROPULSION SYSTEM DESIGN STUDY Progress Report, 1 Jul. - 1 Aug. 1971
P. J. Kelly 1 Aug. 1971 67 p refs
(Contract NAS9-12013)
(NASA-CR-123186; MSC-04422; PR-1) Avail: NTIS CSCL 22B

The development of the requirements for the auxiliary propulsion system used in the baseline orbiter and booster of the space shuttle is discussed. The requirements of principal interest are: (1) engine thrust, (2) number of engines, (3) total system thrust, (4) total impulse, and (5) total impulse expenditure histories. The approach taken to define these requirement and to assess the impact of using common hardware for both the booster and orbiter is presented. Author

N71-38656*# McDonnell-Douglas Astronautics Co., St. Louis, Mo.
SPACE SHUTTLE AUXILIARY PROPULSION SYSTEM DESIGN STUDY: PROGRAM PLAN
P. J. Kelly 15 Jul. 1971 36 p refs
(Contract NAS9-12013)
(NASA-CR-123184; MDC-E0436) Avail: NTIS CSCL 22B

The development of design criteria for the space shuttle reaction control and integrated reaction control/maneuvering systems is discussed. Design criteria are based on the following:

(1) number, location, and thrust level of reaction control system thrusters, (2) vehicle acceleration requirements, (3) failure criteria, and (4) abort requirements. Mission time lines and vehicle configurations are used to determine total impulse requirements, thrust vector control requirements, and component environment.
Author

N71-38657*# McDonnell-Douglas Astronautics Co., St. Louis, Mo.
SPACE SHUTTLE AUXILIARY PROPULSION SYSTEM DESIGN STUDY
1 Jul. 1971 48 p
(Contract NAS9-12013)
(NASA-CR-123181) Avail: NTIS CSCL 22B

The propulsion system configuration for the space shuttle auxiliary propulsion system is discussed. The auxiliary propulsion system requirements are based on the space shuttle vehicle configurations and the vehicle/mission requirements. The auxiliary propulsion system is required to function for a minimum service life of 100 mission cycles over a 10 year period with cost effective refurbishment.
Author

N71-38658*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
RETENTION AND APPLICATION OF SATURN EXPERIENCES TO FUTURE PROGRAMS
W. David Brown and Nancy Milly 14 Sep. 1971 211 p Revised
(NASA-TM-X-64574) Avail: NTIS CSCL 22C

Significant unsatisfactory condition reports are presented. New inspection techniques, developed or refined during the Saturn program, are also identified. The experience and practical benefits of the Saturn program for dissemination and use on future programs are summarized. Three indices are provided for locating specific problems by hardware type, problem type, and physical condition.
Author

N71-38659*# Chrysler Corp., New Orleans, La. Space Div.
SPACE SHUTTLE: INVESTIGATION OF THE MCDONNELL-DOUGLAS ORBITER AND BOOSTER SHUTTLE MODELS IN PROXIMITY AT MACH NUMBERS 2.0 TO 6.0. VOLUME 1: MACH NUMBER 6 BOOSTER PROXIMITY DATA
L. L. Trimmer (AEDC), D. A. Love (LMSC, Huntsville, Ala.), J. P. Decker (NASA Langley Research Center), K. L. Blackwell (NASA, Marshall Space Flight Center), R. H. Burt (AEDC) et al Jul. 1971 426 p refs 7 Vol.
(Contract NAS8-4016)
(NASA-CR-119973; DMS-DR-1108-Vol-1) Avail: NTIS HC $6.00/MF $0.95 CSCL 22B

Aerodynamic data obtained from space shuttle abort stage separation wind tunnel tests are presented. The .00556 scale models of the orbiter and booster configurations were tested in close proximity using dual balances. Data were obtained for both booster and orbiter over an angle of attack range from -10 deg to 10 deg for zero degree sideslip angle. The models were tested at several relative incidence angles and separation distances and power conditions. Plug nozzles utilizing air were used to simulate booster and orbiter plumes at various altitudes along a nominal ascent trajectory. Powered conditions were 100, 50, 25 and 0 percent of full power for the orbiter and 100, 50 and 0 percent of full power for the booster. Pitch control effectiveness data were obtained for both booster and orbiter with power on and off. In addition, launch vehicle data with and without booster power were obtained utilizing a single balance in the booster model. Data were also obtained with the booster canard off in close proximity and for the launch configuration.
Author

N71-38660*# Chrysler Corp., New Orleans, La. Space Div.
SPACE SHUTTLE: INVESTIGATION OF THE MCDONNELL-DOUGLAS ORBITER AND BOOSTER SHUTTLE MODELS IN PROXIMITY AT MACH NUMBERS 2.0 TO 6.0. VOLUME 2: MACH NUMBER 6 ORBITER PROXIMITY DATA
L. L. Trimmer (AEDC), D. A. Love (LMSC, Huntsville, Ala.), J. P. Decker (NASA Langley Research Center), K. L. Blackwell (NASA, Marshall Space Flight Center), R. H. Burt (AEDC) et al Jul. 1971 426 p refs 7 Vol.
(Contract NAS8-4016)
(NASA-CR-119972; DMS-DR-1108-Vol-2) Avail: NTIS HC $6.00/MF $0.95 CSCL 22B
For abstract, see N71-38659.

N71-38661*# Chrysler Corp., New Orleans, La. Space Div.
SPACE SHUTTLE: INVESTIGATION OF THE MCDONNELL-DOUGLAS ORBITER AND BOOSTER SHUTTLE MODELS IN PROXIMITY AT MACH NUMBERS 2.0 TO 6.0. VOLUME 3: MACH NUMBER 3 BOOSTER PROXIMITY DATA
L. L. Trimmer (ARO, Inc.), D. A. Love (LMSC, Huntsville, Ala.), J. P. Decker (NASA Langley Research Center), K. L. Blackwell (NASA, Marshall Space Flight Center), R. H. Burt (ARO, Inc.) et al Aug. 1971 300 p refs 7 Vol.
(Contract NAS8-4016)
(NASA-CR-119971; DMS-DR-1108-Vol-3) Avail: NTIS CSCL 22B
For abstract, see N71-38659.

N71-38662*# Chrysler Corp., New Orleans, La. Space Div.
SPACE SHUTTLE: INVESTIGATION OF THE MCDONNELL-DOUGLAS ORBITER AND BOOSTER SHUTTLE MODELS IN PROXIMITY AT MACH NUMBERS 2.0 TO 6.0 VOLUME 4: MACH NUMBER 3 ORBITER PROXIMITY DATA
L. L. Trimmer (ARO, Inc.), D. A. Love (Lockheed Missiles and Space, Huntsville, Ala.), J. P. Decker (NASA. Langley Res. Center), K. L. Blackwell (NASA. Marshall Space Flight Center), R. H. Burt (ARO, Inc.) et al Aug. 1971 300 p refs 7 Vol.
(Contract NAS8-4016)
(NASA-CR-119968; DMS-DR-1108-Vol-4) Avail: NTIS CSCL 22B
For abstract, see N71-38659.

N71-38663*# Chrysler Corp., New Orleans, La. Space Div.
SPACE SHUTTLE: INVESTIGATION OF THE MCDONNELL-DOUGLAS ORBITER AND BOOSTER SHUTTLE MODELS IN PROXIMITY AT MACH NUMBERS 2.0 TO 6.0. VOLUME 5: MACH NUMBER 2 BOOSTER PROXIMITY DATA
L. L. Trimmer (ARO, Inc.), D. A. Love (LMSC, Huntsville, Ala.), J. P. Decker (NASA. Langley Research Center), K. L. Blackwell (NASA. Marshall Space Flight Center), R. H. Burt (ARO, Inc.) et al Aug. 1971 267 p refs 7 Vol.
(Contract NAS8-4016)
(NASA-CR-119969; DMS-DR-1108-Vol-5) Avail: NTIS CSCL 22B
For abstract, see N71-38659

N71-38664*# Chrysler Corp., New Orleans, La. Space Div.
SPACE SHUTTLE: INVESTIGATION OF THE MCDONNELL-DOUGLAS ORBITER AND BOOSTER SHUTTLE MODELS IN PROXIMITY AT MACH NUMBERS 2.0 TO 6.0. VOLUME 6: MACH NUMBER 2 ORBITER PROXIMITY DATA
L. L. Trimmer (ARO, Inc.), D. A. Love (Lockheed Missiles and Space, Huntsville, Ala.), J. P. Decker (NASA. Langley Research Center), K. L. Blackwell (NASA. Marshall Space Flight Center), R. H. Burt (ARO, Inc.) et al Aug. 1971 266 p refs 7 Vol.
(Contract NAS8-4016)
(NASA-CR-119970; DMS-DR-1108-Vol-6) Avail: NTIS CSCL 22B
For abstract, see N71-38659.

N71-38665*# Chrysler Corp., New Orleans, La.
SPACE SHUTTLE: SUBSONIC LONGITUDINAL AND LATERAL-DIRECTIONAL STABILITY INVESTIGATION OF THE MDAC LCR ORBITER, UNPOWERED AND POWERED
R. Mann, P. J. Seeney, and J. E. Williams May 1971 495 p
(Contract NAS8-4016)
(NASA-CR-119965; DMS-DR-1060) Avail: NTIS CSCL 22B

The 4.0 percent model of the low cross-range orbiter shuttle was tested with both unpowered and powered engine nacelles. The test objectives were the determination of the low speed longitudinal and lateral aerodynamic characteristics and

the jet effects on these characteristics. The test was conducted at a dynamic pressure of 101.5 psf corresponding to a Reynolds number of 1.75 million per foot. The angle-of-attack range was from -10 to +30 degrees and the angle of sideslip range was -6 to +10 degrees. Author

N71-38666*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MISSION TO MARS
Jul. 1971 61 p
(NASA-CR-123156) Avail: NTIS CSCL 22C

The Mariner 9 mission is described along with the experiments to be performed. The Mariner 9 spacecraft was launched in May of 1971 and was expected to arrive on 14 November 1971. During the first 90 days that the spacecraft is in orbit, 70% of the planet's surface will be mapped. Orbit characteristics, science sequencies, spacecraft systems, propulsion, data storage, radio systems, and the central computer are also described. F.O.S.

N71-38667*# Aerojet-General Corp., Azusa, Calif.
BODEPE: IBM 360 COMPUTER CODE FOR THE SNAP-8 BOILER HEAT AND MOMENTUM TRANSFER ANALYSIS
A. J. Sellers 4 Jun. 1971 164 p refs Revised
(Contract NAS5-417)
(NASA-CR-72907; AGC-TM-4921:68-551A) Avail: NTIS CSCL 22B

The method of the thermal design analysis using a computer program coded in FORTRAN 4 and the structure of the computer code is described for a counterflow once through type NaK-to-Hg boiler. The heat and momentum transfer correlations in the code are those established from the wetting and nonwetting two-phase flow models in helical flow passage. Author

N71-38668*# Chrysler Corp., New Orleans, La. Space Div.
SPACE SHUTTLE: AERODYNAMIC HEATING TO THE GRUMMAN SPACE SHUTTLE ORBITERS (ROS-NB1 AND ROS-WB1) AT MACH NUMBER 8.0
A. D'Errico (Grumman Aerospace Corp.) Jul. 1971 78 p
(Contract NAS8-4016)
(NASA-CR-119984; DMS-DR-1154) Avail: NTIS CSCL 22B

The results are presented for a heat transfer wind tunnel test conducted on 0.0067 scale models utilizing the phase-change paint technique. Two delta wing orbiter configurations were investigated. One configuration was tested with a ventral fin on selected runs. Data were obtained for an angle of attack range from 0 to 50 degrees. The test was conducted in a hypersonic wind tunnel at a Mach number of 8.0 and nominal Reynolds numbers per foot of 5 x 10 to the fifth power, 7 x 10 to the fifth power, and 2.0 x 10 to the sixth power. Author

N71-38669*# Chrysler Corp., New Orleans, La. Space Div.
SPACE SHUTTLE: STATIC AERODYNAMIC CHARACTERISTICS FOR THE GAC ROS-NB1 AND ROS-WB1 ORBITER CONFIGURATIONS AT TRANSONIC MACH NUMBERS (M EQUALS 0.7-1.16)
F. Manke (Grumman Aerospace Corp.), R. Krepski (Grumman Aerospace Corp.), and B. Johannesen (Grumman Aerospace Corp.) Aug. 1971 79 p refs
(Contract NAS8-4016)
(NASA-CR-119989; DMS-DR-1161) Avail: NTIS CSCL 22B

Two 1/200 scale models of the Grumman ROS-NB1 and ROS-WB1 space shuttles were tested in the G.A.C. 26 inch transonic wind tunnel. Mach number was varied from .7 to 1.15. Model angle of attack was varied from -3 deg to 13 deg at 0 deg sideslip. Sideslip angle was varied from -2 deg to 10 deg at set angles of attack of 0 deg and 10 deg. Data were taken during a sweep at approximately every .7 deg. Two different basic configurations were tested, the narrow body ROS-NB1, and the wide body ROS-WB1. Test configurations included a model build-up: body alone, body-wing, and body-wing-tail. Symmetric elevon deflections were tested to determine longitudinal control effectiveness. The effect of the rudder, wing tip fins and an auxiliary ventral fin was also determined. All testing was conducted without transition. Author

N71-38670*# Chrysler Corp., New Orleans, La. Space Div.
SPACE SHUTTLE: BASIC HYPERSONIC FORCE DATA FOR GRUMMAN DELTA WING ORBITER CONFIGURATIONS ROS-NB1 AND ROS-WB1
M. Milhous (Grumman Aerospace Corp.), J. Levine (Grumman Aerospace Corp.), and B. Johannesen (Grumman Aerospace Corp.) Aug. 1971 102 p refs
(Contract NAS8-4016)
(NASA-CR-119988; DMS-DR-1159) Avail: NTIS CSCL 22B

Two 1/200 scale models of the Grumman ROS-NB1 and ROS-WB1 space shuttle orbiters were tested in the GAC hypersonic wind tunnel at a Mach number of 10. Model angle of attack was varied from 20 deg to 65 deg at nominal sideslip angles of 0 deg, -3 deg, and -10 deg. Data were taken at approximately 2 deg increments while the model was being pitched at a rate of 8 deg per second. Two different basic configurations were tested, the narrow body ROS-NB1, and the wide body ROS-WB1. Symmetric and asymmetric elevon deflections were tested to determine longitudinal and lateral control effectiveness. The effect of the rudder body flap, an auxiliary ventral fin and a different fuselage nose was also determined. All testing was conducted without transition. Author

N71-38671*# Chrysler Corp., New Orleans, La. Space Div.
SPACE SHUTTLE: DETERMINATION OF THE STATIC STABILITY CHARACTERISTICS OF THE 0.00285-SCALE MDAC PARALLEL BURN LAUNCH CONFIGURATION
Kenneth L. Blackwell (NASA. Marshall Space Flight Center) and David G. Lane (NASA. Marshall Space Flight Center) Sep. 1971 121 p
(Contract NAS8-4016)
(NASA-CR-119991; DMS-DR-1166) Avail: NTIS CSCL 22B

Experimental aerodynamic wind tunnel investigations were conducted on several launch configurations of a parallel burn vehicle. The tests were conducted in a 14 x 14 inch trisonic wind tunnel. Six component aerodynamic force and moment coefficient data are presented in the body axis system and cover a Mach number range from 0.6 to 4.96 over an angle of attack range from -10 deg to 10 deg at zero degrees sideslip and from -4 deg to 10 deg sideslip at 0 deg angle of attack. Thirty test hours were required to accomplish the test. Author

N71-38672*# Chrysler Corp., New Orleans, La. Space Div.
SPACE SHUTTLE: BASIC SUPERSONIC FORCE DATA FOR A GRUMMAN DELTA WING ORBITER CONFIGURATION ROS-NB1
R. Krepski (Grumman Aerospace Corp.), F. Mahnke (Grumman Aerospace Corp.), and B. Johannesen (Grumman Aerospace Corp.) Sep. 1971 90 p
(Contract NAS8-4016)
(NASA-CR-119990; DMS-DR-1163) Avail: NTIS CSCL 22B

Experimental aerodynamic wind tunnel tests were conducted on a 1/200 scale space shuttle model in the 15 inch supersonic wind tunnel. The basic narrow body ROS-NB1 configuration was tested over an angle of attack range from -3 to 22 deg at sideslip angles of 0, 2.6, 3.4, and 4.2 deg and over a sideslip angle range from -5 to 10 deg at set pitch angles of 0, 5, 10, and 15 deg. Test Mach numbers were 1.75, 2.02, and 2.48. Configuration variables included model buildup, symmetric and asymmetric elevon deflection, rudder deflections, and an auxiliary ventral fin. Author

N71-38673*# Chrysler Corp., New Orleans, La. Space Div.
SPACE SHUTTLE: AERODYNAMIC STABILITY AND CONTROL CHARACTERISTICS OF A TBC SPACE SHUTTLE BOOSTER AND GAC ORBITER, M EQUAL 0.6 TO 4.96

J. Johnson and L. L. Watts Aug. 1971 600 p refs
(Contract NAS8-4016)
(NASA-CR-119983; DMS-DR-1148) Avail: NTIS CSCL 22B

Experimental aerodynamic tests were conducted in a trisonic wind tunnel on a 0.002456 scale model of a proposed space shuttle booster, configuration AR1196I-1, and on the booster with a G3-A orbiter mounted in a mid position on top of the booster. Test Mach number from 0.6 to 4.96 with angle of attack varying from -20 deg to 20 deg at 0 deg sideslip and sideslip angle varying from -10 deg to 10 deg at 0 deg, 10 deg, 15 deg, 30 deg and 50 deg angle of attack. Reynolds number varied with Mach number from 5.6 to 11.5 times one million per foot. Plotted data are presented in this report of the six static aerodynamic forces and moments in both the body and stability axis system. Author

N71-38674*# Chrysler Corp., New Orleans, La. Space Div.
SPACE SHUTTLE: BASIC AERODYNAMIC CHARACTERISTICS FOR THREE GAC REUSABLE ORBITAL SPACEPLANE CONFIGURATIONS, ROS-NB1, ROS-NB2, AND ROSWB1 AT 0.17 MACH NUMBER
W. Jung (Grumman Aerospace Corp.) and F. Carlucci (Grumman Aerospace Corp.) Aug. 1971 184 p
(Contract NAS8-4016)
(NASA-CR-119982; DMS-DR-1142) Avail: NTIS CSCL 22B

Three configurations of a reusable orbital spaceplane (ROS) were tested in a low speed wind tunnel. The tests were made with 1/25 scale models to obtain basic subsonic aerodynamic data. The models were pitched over selected angle of attack ranges at fixed sideslip angles of 0 deg and 3 deg and yawed from 15 deg to +15 deg at fixed angles of attack of 0 deg and 20 deg. The nominal test conditions were: Mach number, 0.17; Reynolds number, 1,600,000 per foot; dynamic pressure, 40 psf. Most of the testing was done using the basic body-wing-vertical tail arrangement of configuration ROS-NB1. This configuration, with various elevon, aileron, and rudder deflections, was tested with and without a ground board. Other test parameters included a split rudder, a body flap, turbojet engine pods, and aft end body modifications. In addition, tests were performed on configurations ROS-NB2 and ROS-ROS-WB1; a short nose and wide body configuration respectively. Several runs were also made to test the model in ground effect. The surface of the ground board was located 15 inches below the trunnion. This location of the ground board provided a value for the wing height parameter, h/b= 0.295, where h is the height of the 0.25 MAC above the ground board and b is the wing span. Author

N71-38675*# Chrysler Corp., New Orleans, La. Space Div.
SPACE SHUTTLE: EFFECT OF ORBITER INCIDENCE ANGLE ON THE AERODYNAMIC CHARACTERISTICS OF THE BOEING S-IC BOOSTER/ GAC G-11 ORBITER LAUNCH CONFIGURATION, M EQUAL .6 TO 4.96
L. L. Watts Aug. 1971 621 p refs
(Contract NAS8-4016)
(NASA-CR-119981; DMS-DR-1140) Avail: NTIS CSCL 22B

Experimental aerodynamic investigations were conducted during on a .003366 scale model of the space shuttle orbiter mounted to a Saturn S-IC booster. These tests were conducted in trisonic wind tunnel and covered a Mach number range from 0.6 to 4.96. Primary test objectives were to determine optimum orbiter incidence relative to the booster, and booster fin orientation. Six component static aerodynamic coefficients are presented in plotted form in this report. Author

N71-38676*# Chrysler Corp., New Orleans, La.
SPACE SHUTTLE: STATIC AERODYNAMIC AND CONTROL INVESTIGATION OF AN EXPENDABLE SECOND STAGE WITH PAYLOAD ALONE AND WITH DELTA WING BOOSTER (B-158-1)
E. C. Allen (North American Rockwell Corp., Downey, Calif.) and F. W. Eder (General Dynamics/Convair, San Diego, Calif.) Jun. 1971 210 p
(Contract NAS8-4016)
(NASA-CR-119977; DMS-DR-1119) Avail: NTIS CSCL 22B

Results of experimental aerodynamic investigations in the 14 x 14 inch trisonic wind tunnel on 0.0031 scale models of the expendable second stage (ESS) modified S-2 vehicles are presented. Three different versions of the ESS were tested both alone and mounted piggyback on the space shuttle booster. Six component force and moment data were recorded at Mach numbers from 0.6 to 4.96 over an angle of attack range from -10 to 16 deg at zero degrees sideslip and over a sideslip range from -10 to 10 at 0 and -6 deg angles of attack. Reynolds number varied from 4.4 to 8.9 million per foot. Various booster control surface deflections were tested. Author

N71-38677*# Chrysler Corp., New Orleans, La.
SPACE SHUTTLE: AERODYNAMIC CHARACTERISTICS OF THE NR DELTA WING ORBITER, M EQUALS 0.6 TO 1.3
C. Donald Andrews (LMSC, Huntsville) Sep. 1971 59 p
(Contract NAS8-4016)
(NASA-CR-119976; DMS-DR-1114) Avail: NTIS CSCL 22B

A 0.0035 scale model of the delta wing orbiter was tested in the 14-inch trisonic wind tunnel to obtain force and static stability data from Mach 0.4 to 1.3. The model was tested at angle of attack ranges of 0 to 20, 20 to 40, 40 to 60, and 50 to 70 deg at zero deg sideslip; all control surface deflections were zero. Author

N71-38678*# Chrysler Corp., New Orleans, La.
SPACE SHUTTLE: LOW SPEED CRUISE, TAKEOFF AND LANDING AERODYNAMIC CHARACTERISTICS, INCLUDING ENGINE EXHAUST EFFECTS OF THE GD/C B-158 BOOSTER
J. J. Walker (General Dynamics/Convair, San Diego, Calif.), W. H. Gallaher (General Dynamics/Convair, San Diego, Calif.), and E. Burns (General Dynamics/Convair, San Diego, Calif.) Jul. 1971 384 p
(Contract NAS8-4016)
(NASA-CR-119975; DMS-DR-1110) Avail: NTIS CSCL 22B

A 0.0175 scale space shuttle booster model was tested in a low speed wind tunnel to evaluate some of the low speed takeoff, landing, and cruise characteristics. A delta wing was tested in and out of ground plane, with and without cruise-back engine exhaust plume simulation of the dynamic pressure and mass flow ratios (model to full scale). The exhaust plume simulation engines were non-metric, only the indirect plume effects were measured by the six-component balance. Variations in canard, elevon and rudder deflection were tested at the nominal Mach number of 0.201 and Reynolds number of 1.39 million per foot. The maximum angle of attack range was -4 to +24 degrees, at sideslip angles of 0, 5, and 10 degrees, with smaller ranges for runs in ground plane and cruise engine exhaust simulation. Author

N71-38679*# Chrysler Corp., New Orleans, La.
AERODYNAMIC CHARACTERISTICS OF GD B-158 BOOSTER DURING CRUISE AND LANDING M EQUALS 0.2
J. J. Walker (General Dynamics/Convair, San Diego, Calif.), E. Burns (General Dynamics/Convair, San Diego, Calif.), and W. H. Gallaher (General Dynamics/Convair, San Diego, Calif.) Aug. 1971 289 p
(Contract NAS8-4016)
(NASA-CR-119974; DMS-DR-1109) Avail: NTIS CSCL 22B

A 0.0175 scale model of the space shuttle booster was tested in the low speed wind tunnel to evaluate the low speed aerodynamic characteristics. Four basic wings plus modifications were tested at the nominal Mach numer of 0.201 and Reynolds number of 1.39 million per foot. The Reynolds number was varied from 1.29 to 2.19 million per foot with negligible changes in the data. The model had transition strips on at all times. The angle of attack range was -4 to +24 deg in 2 deg increments, at sideslip angles of 0, 4, and 8 degrees. Variations in canard

position, geometry, and deflections were tested. Only a few elevon deflections were tested for two selected wings, in addition to one larger tail size tested. Author

N71-38680*# Chrysler Corp., New Orleans, La. Space Div.
SPACE SHUTTLE: STATIC LONGITUDINAL, DIRECTIONAL AND LATERAL CHARACTERISTICS AND CONTROL SURFACE EFFECTIVENESS OF THE MDAC-STS CANARD BOOSTER
T. W. Jarrett (McDonnell-Douglas Co., Huntington Beach, Calif.) Aug. 1971 438 p
(Contract NAS8-4016)
(NASA-CR-119978; DMS-DR-1120) Avail: NTIS HC $6.00/MF $0.95 CSCL 22B

Experimental aerodynamic wind tunnel tests were conducted on a 3% model of the space shuttle booster in the low speed wind tunnel. The primary purpose of the test was to define the static longitudinal, directional, and lateral aerodynamic characteristics as well as the control surface effectiveness of the unpowered version of the updated baseline booster and some of its geometric variations. Tests were conducted at a nominal Mach number of 0.26 (q = 100 psf) over an angle of attack range from -6 to 16 deg at 0 deg sideslip and over a sideslip range from -10 to 10 deg at 0, 4, 6, 8, and 10 deg angle of attack. Author

N71-38681*# Chrysler Corp., New Orleans, La. Space Div.
SPACE SHUTTLE: LOW SPEED STABILITY AND CONTROL CHARACTERISTICS OF THE NORTH AMERICAN ROCKWELL DELTA WING ORBITER -134D AND -134C CONFIGURATIONS
O. Sokolsky and W. Lester Jun. 1971 137 p
(Contract NAS8-4016)
(NASA-CR-119979; DMS-DR-1124) Avail: NTIS CSCL 22B

Experimental aerodynamics investigations were conducted on the .00783 scale model delta wing orbiter. These tests were run at the corporation's low speed wind tunnel at a Mach number of 0.26 (RN/L = 1.85 million) over an angle of attack range from 0 to 40 deg at zero degrees sideslip and from -5 to 10 deg sideslip angle at 0, 10, 20, 30, and 40 deg angle of attack. Various combinations of elevons and elevon deflections and rudder deflections were tested. Plotted data are presented in the stability axis system for longitudinal results and in stability and body axis for lateral-directional results. Author

N71-38682*# Chrysler Corp., New Orleans, La. Space Div.
SPACE SHUTTLE: STATIC STABILITY AND CONTROL CHARACTERISTICS OF THE NR DELTA WING (134D) SPACE SHUTTLE ORBITER, M EQUALS 0.6 - 5.0
E. C. Allen Aug. 1971 528 p refs
(Contract NAS8-4016)
(NASA-CR-119980; DMS-DR-1126) Avail: NTIS HC $6.00/MF $0.95 CSCL 22B

Experimental aerodynamic investigations were made on a 0.0035 scale model of the delta wing (134D) space shuttle orbiter in the 14-inch trisonic wind tunnel. Tests were conducted over a Mach number range from 0.6 to 4.96 at Reynolds numbers from 4.4 to 8.9 million per unit length. The test primary objectives were control evaluations, therefore the delta wing elevon was deflected symmetrically over a range from -20 to +20 deg and unsymmetrically (aileron control about some elevator setting) at selected positions for aileron deflections of 0, -20, and -40 deg. The above conditions were evaluated at 0 and 6 deg sideslip angle over an angle of attack range from -10 to 30 deg, and over an angle of sideslip range from -10 to 10 deg at angles of attack of 0, -6, and 6 deg. Author

N71-38683*# Biotechnology, Inc., Falls Church, Va.
DISPLAY REQUIREMENTS AND CONCEPTS FOR SPACE SHUTTLE RECOVERY AND LANDING
Walter B. Gertner and Larry L. Janney Jul. 1971 80 p refs
(Contract NASw-1987)
(NASA-CR-123151) Avail: NTIS CSCL 22C

Space shuttle mission requirements are reviewed with emphasis placed on those related to orbiter recovery and landing. Vehicle control requirements are defined along with generalized flight profiles and control schemes in VFR and IFR conditions. Advanced display concepts and technology are analyzed and data are derived for use in the design of displays to support the space shuttle crew in their roles of managing, monitoring, and controlling recovery and landing. In addition, recommendations are given for further display design and development activities. D.L.G.

N71-38684*# McDonnell-Douglas Astronautics Co., St. Louis, Mo.
SIMULATIONS TO SUPPORT SYSTEMS ENGINEERING/ INTEGRATION Final Report
W. W. Schramm and C. L. Hoyt 15 Sep. 1971 352 p
(Contract NAS8-26920)
(NASA-CR-120084; MDC-E0448) Avail: NTIS HC $6.00/MF $0.95 CSCL 22B

Simulations required to support systems engineering and integration efforts related to the Space Shuttle development program are defined. The study identified 62 Booster vehicle and 69 Orbiter vehicle analyses and studies requiring support of simulation tasks. A summary list of these analyses and studies is presented. Simulation Requirements Descriptions (SRD's) were prepared for each Booster and Orbiter simulation task. These SRD's documented in detail the following (1) the objective of each simulation task, (2) the justification for using simulation techniques, (3) the description of the simulation task, (4) the generic facility requirements, and (5) the schedule showing relation to program milestones. Eleven Booster simulation facilities and sixteen Orbiter simulation facilities were identified as generic facility types required to perform the simulations. A list summarizing facility requirements is presented. Author

N71-38685*# Biotechnology, Inc., Falls Church, Va.
HUMAN FACTORS TECHNOLOGY REQUIREMENTS IN SPACE SHUTTLE DEVELOPMENT
Walter B. Gartner, Harold E. Price, Vita West, and James F. Parker, Jr. Aug. 1971 103 p refs
(Contract NASw-1987)
(NASA-CR-123166) Avail: NTIS CSCL 05E

Potential human factors problems in man-machine interfaces in space shuttle systems are described. Necessary advances in human factors technology in order to resolve the problems are identified. Various problem areas are discussed including reentry transition cardiovascular deconditioning and transition from space control to aerodynamic control of the system; manual control of the booster vehicle during ascent and reentry; design problems for a habitable life support system; crew and passenger safety; the role of the crew in mission management and subsystem control; pilot monitoring and vehicle control during recovery operations; man-computer interfaces; flight deck external vision; and transfer of personnel or cargo. J.M.

N71-38686*# Sperry Rand Corp., St. Paul, Minn. Defense Systems Div.
SPACE SHUTTLE BOOSTER DATA MANAGEMENT SYSTEM (DMS) REQUIREMENTS ANALYSIS. VOLUME 1: STUDY SUMMARY Final Report
C. L. Lutes and K. M. Hoglund 24 Sep. 1971 144 p refs
(Contract NAS8-30186)
(NASA-CR-119953; PX-6550-1-Vol-1) Avail: NTIS CSCL 22B

Computational and data handling functions representative of the requirements of the data management system for the space shuttle booster avionics system are presented. The functional requirements for each subsystem throughout the mission profile were developed. The functional requirements were expanded into detailed computational requirements in the form of flow diagrams, equations, logic, and mission phase requirements. Author

N71-38687*# Sperry Rand Corp., St. Paul, Minn. Defense Systems Div.
SPACE SHUTTLE BOOSTER DATA MANAGEMENT SYSTEM (DMS) REQUIREMENTS ANALYSIS. VOLUME 2: DETAIL REQUIREMENTS Final Report
C. L. Lutes and K. M. Hoglund 24 Sep. 1971 581 p
(Contract NAS8-30186)
(NASA-CR-120093; PX-6551-2-Vol-2) Avail: NTIS HC $6.00/MF $0.95 CSCL 22B

Detailed definitions of the subsystem interfaces with the data management system of the space shuttle are presented. The requirements to interface directly with a digital computer are compared with the requirements to interface with the data bus system. The input/output requirements are presented for: (1) structures, (2) propulsion, (3) electric power generation and distribution, (4) navigation and guidance, (5) flight control, and (6) operations management. Author

N71-38688*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
STABLE LONGITUDES FOR 12 HOUR ECCENTRIC ORBIT SATELLITES
Carl A. Wagner Sep. 1971 45 p refs Presented at the 1st Goddard Astrodynamics and Geodynamics Conf., Greenbelt, Md., Oct. 1971 Submitted for publication
(NASA-TM-X-65722; X-553-71-405) Avail: NTIS CSCL 22C

The accelerated longitude drift regimes of eccentric 12 hours orbits due to resonant geopotential are considered. These quasi-stationary orbits are under investigation for large payload earth surveillance spacecraft in the small applications technology satellite (SATS) program. Inclinations near 'critical' are especially attractive because of their possible long term stability, and these are examined in detail. 'Stable' equator crossing longitudes for these satellites are found as functions of the argument of perigee. As long as the argument of perigee is between + or - 100 deg, these 'stable' longitudes lie within a narrow range. Maximum 'east-west' station keeping requirements for these satellites at nonequilibrium positions are in the range of .3 to 3 m/sec/yr. Author

N71-38689*# Aerospace Corp., El Segundo, Calif. Applied Mechanics Div.
SAFETY ANALYSIS OF PARALLEL VERSUS SERIES PROPELLANT LOADING OF THE SPACE SHUTTLE. VOLUME 2: TECHNICAL DISCUSSION Final Report
Otto Hamberg and F. D. Tomlinson 30 Jun. 1971 58 p refs
(Contract NASw-2129)
(NASA-CR-123172; ATR-71(7233)-1-Vol-2) Avail: NTIS CSCL 21I

Under the conditions of equal total propellant loading time, parallel loading was found to be potentially more hazardous than series loading; this is due to (1) the greater explosion potential of the propellants in the vehicle tanks during the entire loading operation, and (2) the simultaneous relatively high flow rates in the loading lines. However, it was also determined that by reducing the parallel loading time to approximately one-half the series loading time, the higher hazard associated with parallel loading could be reduced to an acceptable value. Since this would require a system size approximately equal to that necessary for series loading, the economic advantage of parallel loading would be negated. If it is assumed that only a relatively small percentage of vehicles will require a short reaction time on the launch pad, then, the lower cost of parallel loading can be realized by designing a smaller system and operating it in series for a normal loading time of 150 minutes. Where minimum reaction time is required, the propellants could be loaded in approximately 75 minutes by operating the same system in parallel at a relatively small additional risk. for Vol. 1, see N71-38690. Author

N71-38690*# Aerospace Corp., El Segundo, Calif. Systems Planning Div.
SAFETY ANALYSIS OF PARALLEL VERSUS SERIES PROPELLANT LOADING OF THE SPACE SHUTTLE VOLUME 1: MANAGEMENT SUMMARY REPORT Final Report
R. R. Wolfe 30 Jun. 1971 23 p
(Contract NASw-2129)
(NASA-CR-123153; ATR-71(7233)-1-Vol-1) Avail: NTIS CSCL 22B

An evaluation of the overall hazards pertaining to the propellant loading of the Space Shuttle leads to the conclusion that for equal total loading times the parallel loading method is potentially more hazardous than the series method of loading. To obtain the best features of both systems at a minimum safety impact, it is recommended that the system be designed to operate in either mode with series loading used as the normal mode of operation. To operate in this manner the time allocated for series loading would have to be twice that considered for parallel loading (e.g., 150 minutes for series and 75 minutes for parallel). This would allow for reducing the reaction time in an emergency. In addition, it is suggested that the hazard level for the two system be made equal by utilizing identical hardware, which would result in the potential cost savings indicated for the parallel system. E.M.C.

N71-38691*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PROJECT RANGER: A CHRONOLOGY
R. Cargill Hall Apr. 1971 592 p refs
(Contract NAS7-100)
(NASA-CR-123168; JPL/HR-2) Avail: NTIS HC $6.00/MF $0.95 CSCL 22B

A detailed chronology is presented of the Ranger project activities and those events which affected the project for the years 1957 through 1965. These include the successes and failures, accomplishments and disappointments, and background information on the history and development of the Jet Propulsion Laboratory. N.E.N.

N71-38692*# Advanced Technology Center, Inc., Dallas, Tex.
RADIATION AND METEOROID SATELLITE Final Report
J. H. Johnson, B. J. Farmer, R. G. Bagwell, and B. R. King Mar. 1971 119 p refs
(Contract NAS8-9195)
(NASA-CR-115206; B-95000/1CR-11) Avail: NTIS CSCL 22B

The Radiation and Meteoroid Satellite program demonstrated that a sophisticated, piggy-back satellite system composed of two complex experiments, a solar power supply, telemetry, an on-board memory, and a computer/controller could be conceived, designed, fabricated, and flown on a Scout launch vehicle in less than two and one-half years for a total expenditure of less than one million dollars. Although system redundancy was eliminated for economy, sufficient versatility was designed into the satellite to overcome a significant problem caused by a vehicle malfunction at separation. The suspected collision at separation compromised the high energy proton data, but all other portions of the radiation experiment were completed and the real-time spectrum to dose conversion system was demonstrated in the space environment. The meteoroid experiment produced two meteoroid velocity measurements during its short lifetime. Data was also accumulated to determine meteoroid flux. Author

N71-38693*# Vought Missiles and Space Co., Dallas, Tex.
SCHEDULING TECHNIQUE IMPROVEMENT STUDY FOR ADVANCED PROGRAMS. VOLUME 1: SUMMARY Final Report
D. P. Crain 25 Jul. 1971 316 p refs 4 Vol.
(Contract NAS9-11659)
(NASA-CR-115217; LTV-00.1444-Vol-1; MSC-04081-1-Vol-1) Avail: NTIS HC $6.00/MF $0.95 CSCL 22B

The results are given of a program to generate improved techniques for scheduling major advanced space programs. The basic technique employed is termed "time estimating relationships", where relationships are derived from statistical data to relate time to those technical parameters judged to be drivers in

subsystem, system, or total program scheduled development and delivery. The material presented includes: (1) a master schedule for developing an advanced space transport program, (2) the work breakdown structure and dictionary (work statement) for the program, (3) the detail schedules developed by standard techniques for estimating design and development, and (4) the logic diagrams which identify principle tasks and their sequence.
Author

N71-38694*# Vought Missiles and Space Co., Dallas, Tex.
SCHEDULING TECHNIQUE IMPROVEMENT STUDY FOR ADVANCED PROGRAMS. VOLUME 2: STAGE 2 ADVANCED SPACE TRANSPORT PROGRAM Final Report
D. P. Crain 25 Jul. 1971 367 p 4 Vol.
(Contract NAS9-11659)
(NASA-CR-115218; LTV-00.1444-Vol-2; MSC-04061-2-Vol-2)
Avail: NTIS HC $6.00/MF $0.95 CSCL 22B

Scheduling techniques are presented pertaining to stage 2 (a manned, reusable orbiting transport vehicle) of an advanced space transport program. A work breakdown structure dictionary, detail schedules, and logic diagrams are included. D.L.G.

N71-38695*# Vought Missiles and Space Co., Dallas, Tex.
SCHEDULING TECHNIQUE IMPROVEMENT STUDY FOR ADVANCED PROGRAMS. VOLUME 3: STAGE 1 ADVANCED SPACE TRANSPORT PROGRAM Final Report
D. P. Crain 25 Jul. 1971 196 p refs 4 Vol.
(Contract NAS9-11659)
(NASA-CR-115219; LTV-00.1444-Vol-3; MSC-04061-3-Vol-3)
Avail: NTIS CSCL 22B

WBS dictionary, schedules and logic diagrams are presented for stage 1 (the manned, reusable boost vehicle). Systems described include: primary cryogenic storage, propulsion and power plant, environmental control and life support, communications and navigation aids, and data management. F.O.S.

N71-38696*# Vought Missiles and Space Co., Dallas, Tex.
SCHEDULING TECHNIQUE IMPROVEMENT STUDY FOR ADVANCED PROGRAMS. VOLUME 4: GROUND SUPPORT, TEST, TRAINING, INVESTMENT, OPERATIONS, ADVANCED SPACE TRANSPORT PROGRAM Final Report
D. P. Crain 25 Jul. 1971 408 p refs 4 Vol.
(Contract NAS9-11659)
(NASA-CR-115220; LTV-00.1444-Vol-4; MSC-04061-4-Vol-4)
Avail: NTIS HC $6.00/MF $0.95 CSCL 22B

WBS dictionary, schedules and logic diagrams for ground support, testing, training and management are presented for an advanced space transport program. Systems described include: ground communications, command and control, recovery equipment, and systems test and evaluation. F.O.S.

N71-38697# Naval Weapons Lab., Dahlgren, Va.
EFFECTS OF AERODYNAMIC ANGULAR-RATE NONLINEARITIES ON MISSILE DYNAMIC STABILITY
Thomas A. Clare Apr. 1971 31 p refs
(AD-727113; NWL-TR-2562) Avail: NTIS CSCL 16/4

The effects of aerodynamic damping coefficients nonlinear with angular velocity on the dynamic stability of statically stable configurations of symmetric missiles are investigated analytically and verified via numerical simulations. In particular, the simplest mode of oscillation, single degree of freedom pitching motion, is considered including a restoring moment nonlinear with angle of attack and a damping moment nonlinear with both angle of attack and angular velocity. Averaging methods are used to obtain an approximate expression for the frequency and amplitude variations with time. It is noted that the internal mass distribution (moment of inertia) can be a critical factor in the interpretation of dynamic stability characteristics from single degree of freedom wind tunnel tests, especially when employing light-weight models. Author (GRA)

N71-38698# Aerospace Corp., San Bernardino, Calif.
HEAT TRANSFER CORRELATIONS FOR BLUNT CONES AT ANGLE OF ATTACK
George F. Widhopf 15 Jul. 1971 45 p refs
(Contract F04701-71-C-0172)
(AD-727787; TR-0172(S2816-63)-1) Avail: NTIS CSCL 16/3

A simple correlation of the local nondimensional heat transfer rate with the local nondimensional pressure ratio for blunt cones at angles of attack is presented. The correlation is demonstrated utilizing two comprehensive sets of experimental data; one for the turbulent case and one for the laminar case. In each case, the correlation is of the form of a set of power laws (an individual power law for each conical surface location) and includes the effect of streamline spreading and entropy swallowing on the evaluation of the local heat transfer rate. At each station, the individual power law correlates the circumferential variation for a spectrum of angles of attack. It is shown that the slope of each of the individual power laws in a particular set is the same and that the power law coefficient can be accurately predicted from the zero angle-of-attack distribution. Numerical and analytic results are presented which identify the dependence of the nondimensional heat transfer rates on the various independent flow parameters and also indicate the extension of this type of correlation to conditions other than the experimental ones considered herein. Author (GRA)

N71-38699# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ON NONLINEAR LAWS OF CONTROL OF A GLIDING WINGED SPACE APPARATUS IN COMING OUT OF CIRCULAR ORBIT ONTO A RUNWAY
V. S. Vedrov et al 9 Mar. 1971 27 p refs Transl. into English from the report "Avtomicheskoe Upravlenie Kosmicheskimi Letatelnymi Apparatami" Moscow, 1968 p 423-433
(AD-727450; FTD-MT-24-324-70) Avail: NTIS CSCL 22/2

The article discusses some of the problems involved in bringing a winged space apparatus down at a landing site from a circular orbit. It discusses longitudinal and lateral control of the aircraft in the descent process. A system for the automatic control of the space apparatus in the descent process is described, with emphasis on the effect of various disturbances.
GRA

N71-38700*# National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.
FLIGHT-MEASURED HL-10 LIFTING BODY CENTER FIN LOADS AND CONTROL SURFACE HINGE MOMENTS AND CORRELATION WITH WIND-TUNNEL PREDICTIONS
Ming H. Tang and George P. E. Pearson Washington Oct. 1971 38 p refs
(NASA-TM-X-2419; H-669) Avail: NTIS CSCL 22B

Subsonic, transonic, and supersonic aerodynamic loads data are presented for the center fin and the control surfaces of the HL-10 lifting body vehicle. The effects of variations in angle of attack, angle of sideslip, aileron deflection, rudder deflection, and Mach number on the center fin loads are presented in terms of coefficient slopes. The effects of vehicle attitude, control surface deflection, Mach number, and rocket engine operation on the outboard and inboard tip fin flaps, rudder, elevon flap, and elevon hinge-moment coefficients are discussed. The flight test aerodynamic loads are compared with full-scale and small-scale wind-tunnel data. Author

N71-38701*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
TECHNIQUES FOR ACHIEVING MAGNETIC CLEANLINESS ON DEEP-SPACE MISSIONS
W. S. West, J. M. Holman (RCA Astro-Electronics Div.), and H. Bilsky (RCA Astro-Electronics Div.) Washington Oct. 1971 77 p refs
(NASA-TR-R-373; G-1031) Avail: NTIS CSCL 22B

Engineering considerations associated with design, development, and test of spacecraft and subsystems that achieve

sufficiently low levels of magnetic interference at the magnetometers to permit scientific measurement are described. Engineering methods and data are provided for selecting different background interference values, with 0.1 gamma being the value selected for illustration purposes in the study. Unique magnetic considerations associated with nuclear power supplies are covered and selected test data are presented. Author

32 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; thermal stress; impact phenomena; vibration; flutter; inflatable structures; and structural tests. For related information see also: 17 Materials, Metallic; and 18 Materials, Nonmetallic.

N71-38702*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

FINITE ELEMENT APPENDAGE EQUATIONS FOR HYBRID COORDINATE DYNAMIC ANALYSIS

Peter W. Likins (Calif. Univ., Los Angeles) 15 Oct. 1971 36 p refs

(Contracts NAS7-100; NAS8-26214)

(JPL-TR-32-1525; NASA-CR-123213) Avail: NTIS CSCL 20K

The increasingly common practice of idealizing a spacecraft as a collection of interconnected rigid bodies to some of which are attached linearly elastic flexible appendages leads to equations of motion expressed in terms of a combination of discrete coordinates describing the arbitrary rotational motions of the rigid bodies and distributed or modal coordinates describing the small, time-varying deformations of the appendages. Such a formulation is said to employ a hybrid system of coordinates. Hybrid coordinate equations of motion for a finite element model of a flexible appendage attached to a rigid base undergoing unrestricted motions are discussed and some of the advantages of the finite element approach are noted. Transformations to the modal coordinates appropriate for the general case and various special cases are provided. Author

N71-38703# Atomic Weapons Research Establishment, Aldermaston (England).

SURVEY OF THE EFFECTS OF POROSITY ON THE ELASTIC MODULI AND STRENGTH OF BRITTLE MATERIALS WITH PARTICULAR REFERENCE TO BERYLLIUM

R. E. Cooper, R. E. Rowland, and D. Beesley Apr. 1971 18 p refs

(AWRE-O-25/71) Avail: AEC Depository Libraries; HMSO 15 p; SIS 80.60

The effects of porosity on the elastic and strength properties of brittle materials are surveyed and compared with data obtained on beryllium. It is shown that beryllium exhibits monotonic decreases in its elastic moduli and various strength properties with increasing porosity but that its Poisson's ratio remains constant. The mechanical properties at high strains are more strongly dependent on porosity than those at lower strains, and reasons for this are suggested. Author (NSA)

N71-38704*# Tennessee Technological Univ., Cookeville. Dept. of Engineering Science.

A PHOTOELASTIC INVESTIGATION OF STRESS WAVE LOADING OF A CRACK

Dallas G. Smith Sep. 1970 31 p refs

(Grant NGR-43-003-007)

(NASA-CR-123179; TTU-ES-70-4) Avail: NTIS CSCL 20K

Using a photoelastic technique the dynamic stress intensity factor for the wave loading of a crack is investigated, and the dynamic polariscope is described. Five different crack lengths were considered and the pulse length was approximately constant. The dilatational wave impinged normal to the crack and the form of the incident wave was determined. The time response of the stress intensity factor is shown for each crack length and the effect of the crack length to pulse length ratio on the maximum stress intensity is presented. Author

N71-38705*# Tennessee Technological Univ., Cookeville. Dept. of Engineering Science.

DYNAMIC ELASTICITY BY THE THEORY OF CHARACTERISTICS

George R. Buchanan, Chi-Houng Phung, and Ju-Chin Huang Sep. 1970 14 p refs

(Grant NGR-43-003-007)

(NASA-CR-123178; TTU-ES-70-5) Avail: NTIS CSCL 20K

A characteristic analysis is presented for the equations of elasticity in Cartesian coordinates. The characteristic slope equations are derived, and it is verified that two types of waves exist. The compatibility equations are developed in relation to the direction cosines of a spherical coordinate system. A brief discussion of the method of analysis is included. Author

N71-38706*# Aerojet-General Corp., Azusa, Calif. Power Systems Div.

VIBRATION TESTS WITH THE SNAP-8 CONDENSER P/N 003945-1, S/N A-1

E. S. Chalpin and G. L. Lombard 21 Apr. 1970 84 p refs

(Contract NAS3-13458)

(NASA-CR-72925; AGC-TM-7998:70-624) Avail: NTIS CSCL 20K

The SNAP 8 condenser consists of 73 tapered 9% chromium, 1% molybdenum steel tubes contained in a stainless steel shell. Mercury vapor enters the larger end of the condenser and flows through the tapered tubes while NaK, flowing counter to the mercury, passes through the space within the shell and around the tube bundle. During normal operation, the condenser is in the vertical position with the mercury vapor end up. Environmental testing was done to evaluate the basic structural design at conditions that are expected during a vehicle launch and/or landing and maneuvering mode in space. The NaK inlet and outlet ports were removed at one and one-half inches from the manifolds. The NaK fluid was simulated during vibration testing with an oil which has a density and viscosity at room temperature close to that of NaK at 600 F. The mercury side was not filled since it is normally empty during launch. Sinusoidal, random, and shock tests were performed along three mutually perpendicular axes. Author

N71-38707*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

LIQUID OSCILLATION FREQUENCIES ON TILTED CYLINDERS FOR FIVE CROSS-SECTION SHAPES

Stephen Thornton and Frank Bugg 1 Oct. 1971 28 p refs

(NASA-TM-X-64818) Avail: NTIS CSCL 20K

The frequency of liquid oscillations was measured in cylindrical tanks with cross-section shapes formed by a circular arc and a straight line. The shapes were related to some feasible and proposed space shuttle tank cross sections and ranged from circular to approximately semi-circular. The frequencies were measured with the tank axes tilted 0 deg to 60 deg from the local vertical. Oscillations were excited both by forces in the plane of the tilt angle and forces perpendicular to the plane of the tilt angle. The data were compared with theoretical results for frequency in tilted circular cylindrical tanks and theoretical results for one upright cylindrical tank with non-circular cross section. Author

N71-38708# Grumman Aerospace Corp., Bethpage, N.Y.

AXIALLY SYMMETRIC TRANSIENT WAVE PROPAGATION IN ELASTIC RODS WITH NONUNIFORM SECTION

P. C. Y. Lee and Y. S. Wang Sep. 1971 61 p refs

(RE-415; RR-71-1) Avail: NTIS

A one dimensional approximate theory is derived for an elastic circular rod with nonuniform cross section. Three coupled equations, taking into account the longitudinal, radial, and axial

shear deformations and their inertias, are obtained as an extension of the Mindlin-McNiven theory to the case of nonuniform rods. Responses of both the semi-infinite rod and finite rod with elastic end support due to either a step or a pulse loading are studied by the method of characteristics. Calculated results such as stresses versus time for different stations along the rod and stresses as functions of distance for instants of time are presented and compared for several cases. The geometrical effect of the variation of section on the stresses and velocities and the effect of the elastic support on the reflection and propagation of the stress waves are deduced. Author

N71-38709# Florida Univ., Gainesville. Engineering and Industrial Experiment Station.
DYNAMIC BUCKLING OF THIN ELASTIC SHELLS Final Technical Report, 31 Jul. 1962 - 30 Jun. 1967
William A. Nash Jun. 1971 105 p refs
(Grant DA-ARO(D)-31-124-G372)
(AD-726397; ARGD-3368-5-E) Avail: NTIS CSCL 20/11

The report summarizes five studies in the statics and dynamics of thin elastic shells of cylindrical, spherical, and conical shape. Various types of time-dependent loads are considered and the responses of the shells investigated by a variety of techniques. Agreement of theory with available experimental evidence is discussed where possible.
Author (GRA)

N71-38710# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
REMOVAL OF RESIDUAL STRESSES IN VESSELS BY INTERNAL PRESSURE
I. V. Tkachev et al 24 Apr. 1971 19 p refs Transl. into ENGLISH from Kuznechno-Shtampovochnoe Proizvod. (USSR), v. 12, no. 10, 1970 p 23-26
(AD-727248; FTD-HC-23-157-71) Avail: NTIS CSCL 13/8

Residual stresses have a considerable influence on the quality and durability of parts made by methods of metal pressure-working. In the past, however, insufficient attention has been paid to the problem of determining their magnitude and the nature of distribution of these stresses in different technological processes in automatic-forging production. In the leading branches of mechanical engineering, technological processes are evaluated on the basis of the magnitude and extent of the residual stresses in the finished parts. For example, the technological process of manufacturing engine blades is evaluated in this manner in the aircraft construction industry. The tensile residual stresses that develop during bending on the internal surface of parts that are cylindrical in shape constitutes a danger in the presence of aggressive media. Thus, corrosion cracking of apparatus occurs in the chemical and petroleum machine building industry. In addition, residual stresses considerably reduce strength during operation under conditions of varying stress. Residual stresses can usually be removed by thermal working of the parts.
Author (GRA)

N71-38711# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
A METHOD OF EVALUATING CYCLIC CREEP
V. I. Kovpak et al 23 Mar. 1971 10 p refs Transl. into ENGLISH from Proceedings of Conf. on the Materials of the 5th All-Union Scientific-Technical Conf. of the Ukrainian Academy of Sciences Inst. of Strength Problems in Dec. 1967 (USSR), no. 5, 1969 p 42-44
(AD-727263; FTD-HC-23-663-70) Avail: NTIS CSCL 20/11

A derivation is given of a relation for determining the effective stress under conditions of cyclic loading (loads varying according to a trapezoidal cycle) in the evaluation of the behavior of materials in the presence of cyclic creep. It is shown that the relation is useful in the conversion of stationary test data to cyclic creep and fatigue data. Author (GRA)

N71-38712# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
STRENGTH CONDITIONS UNDER THE VARYING STRESSES OF AN UNSTEADY CONDITION WITH RESPECT TO THE BREAKDOWN PROBABILITY PARAMETER
L. A. Kozlov 7 May 1971 40 p Transl. into ENGLISH from Prochnost i Dinam. Aviats. Dvigatelei Sb. Statei (USSR), no. 5, 1969 p 193-213
(AD-727472; FTD-MT-24-354-70) Avail: NTIS CSCL 21/5

An attempt to determine the strength characteristics of materials with respect to the breakdown probability parameter by statistical analysis of the fatigue stability characteristics under unsteady loads subject to various distribution laws is given. It is shown that real load spectra cannot be adequately described by assuming single-parameter load distributions. A second load distribution parameter is introduced in the procedure, and the results are compared with a reference load spectrum. Recommendations are made concerning the statistical strength analysis of materials with respect to the breakdown probability parameter. GRA

N71-38713# Boeing Co., Seattle, Wash. Aerospace Group.
ELECTRONIC SIGNAL PROCESSING TECHNIQUES, PHASE 3: NONDESTRUCTIVE TESTING Semiannual Report, 30 Dec. 1970 - 30 May 1971
James C. Kennedy and Wayne E. Woodmansee Jun. 1971 40 p refs See also Semiannual Rept. dated Nov. 1970, AD-716803; N71-21678
(Contract DAAA25-69-C-0206; ARPA Order 1246)
(AD-727156; D180-10589-2) Avail: NTIS CSCL 14/2

Correlation techniques were used to improve the signal to noise ratio in the ultrasonic inspection of a simulated weld seam. A quarter inch titanium plate, containing EDM slots and drill holes, was inspected ultrasonically. The inspection was performed as if the plate contained a weld seam with potential flaws. The limiting background noise was due to surface roughness and grain boundary scattering. The weld line was inspected three times, a different transducer configuration being used for each inspection. The three sets of data were multiplied together. The signal to noise ratio for the ultrasonic reflection from a ten (10) mil drill hole was improved from a value of one to one to a value of five to one. The development of automatic scanning procedures appears possible. Author (GRA)

N71-38714# Naval Postgraduate School, Monterey, Calif.
THREE-DIMENSIONAL ELASTO-STATIC PROBLEMS USING ISOPARAMETRIC FINITE ELEMENTS
Dale Eugene Hanson (M.S. Thesis) Jun. 1971 94 p refs
(AD-727117) Avail: NTIS CSCL 20/11

The objective of the project described in this report was to develop a computer system which would generate the required input data for a structural analysis of three-dimensional elasto-static problems using isoparametric finite elements. Element connectivity, nodal point coordinates, consistent gravity loads, and consistent pressure loads are generated. A variety of algorithms are used in the system to reduce the amount of input data required. The computer system and a sample problem are discussed. Author (GRA)

N71-38715# Tohoku Univ., Sendai (Japan).
REPORTS OF THE RESEARCH INSTITUTE FOR STRENGTH AND FRACTURE OF MATERIALS, VOLUME 6, NO. 2
Dec. 1970 38 p refs
Avail: NTIS

CONTENTS:

1. X-RAY MICROBEAM STUDIES ON PLASTIC ZONE AT THE TIP OF THE FATIGUE CRACK T. Yokobori, K. Sato, and Y. Yamaguchi p 49-67 refs (See N71-38716 24-32)

2. DELAYED FRACTURE OF HIGH STRENGTH STEEL AS STOCHASTIC PROCESS IN TERMS OF NUCLEATION THEORY AND DELAYED FRACTURE TOUGHNESS T. Yokobori and T. Kawasaki p 69-74 refs (See N71-38717 24-32)

3. A KINETIC THEORY OF FATIGUE CRACK PROPAGATION BASED ON VACANCY CONDENSATION MECHANISM T. Yokobori and M. Ichikawa p 75-88 refs (See N71-38718 24-32)

N71-38716# Tohoku Univ., Sendai (Japan). Dept. of Mechanical Engineering.
X-RAY MICROBEAM STUDIES ON PLASTIC ZONE AT THE TIP OF THE FATIGUE CRACK
Takao Yokobori, Kiyoshi Sato, and Yasuo Yamaguchi *In its* Rept. of the Res. Inst. for Strength and Fracture of Mater., Vol. 6, No. 2 Dec. 1970 p 49-67 refs (See N71-38715 24-32)
Avail: NTIS

The relations between the stress intensity factor and substructures such as total misorientation, excess dislocation density, and microscopic plastic zone size at the tip of the fatigue crack; and the relations between the fatigue crack propagation rate and these substructures were studied using the X-ray microbeam method. It is concluded that the total misorientation at the tip of the fatigue crack increases linearly in log-log plot against the stress intensity factor and crack propagation rate. The equations for relating the maximum excess dislocation density at the crack tip of the fatigue to stress intensity factor and crack propagation rate are given. F.O.S.

N71-38717# Tohoku Univ., Sendai (Japan). Dept. of Mechanical Engineering.
DELAYED FRACTURE OF HIGH STRENGTH STEEL AS STOCHASTIC PROCESS IN TERMS OF NUCLEATION THEORY AND DELAYED FRACTURE TOUGHNESS
Takao Yokobori and Tadashi Kawasaki *In its* Rept. of the Res. Inst. for Strength and Fracture of Mater., Vol. 6, No. 2 Dec. 1970 p 69-74 refs Presented at the 20 Czech. Symp. on Fracture, Marianske Lazne, Czechoslovakia, Oct. 1970 (See N71-38715 24-32)
Avail: NTIS

The formulation for fatigue crack propagation rate assuming the phenomena to be a stochastic process, was investigated as follows: dc/dN = eta mu where eta = the increment of the crack per each stage, mu = the probability of occurrence of the increment per cycle at the Nth cycle under the condition the increment did not occur until (N-1) th cycle. Mu is interpreted as the nucleation rate of a fatigue microcrack at the concerned crack. The principle was applied to the problem of delayed fracture of high strength steel. The concept of delayed fracture toughness is proposed. Author

N71-38718# Tohoku Univ., Sendai (Japan). Dept. of Mechanical Engineering.
A KINETIC THEORY OF FATIGUE CRACK PROPAGATION BASED ON VACANCY CONDENSATION MECHANISM
Takao Yokobori and Masahiro Ichikawa *In its* rept. of the Res. Inst. for Strength and Fracture of Mater., Vol. 6, No. 2 Dec. 1970 p 75-88 refs (See N71-38715 24-32)
Avail: NTIS

A specific mechanism of the microcrack nucleation is proposed in which voids are nucleated by vacancy condensation near the tip of the crack, and theoretical calculations are attempted based on the mechanism. The theory leads to a crack propagation law of the type of dc/dN = C sub 1 K sub m(delta) which is of the same type as the one previously derived. Author

N71-38719# Austin Science Associates, Inc., Tex.
MEASUREMENT OF SURFACE STRESS VIA THE MOESSBAUER EFFECT Final Report, 15 Jun. 1969 - 15 Jun. 1971
R. L. Collins, M. C. Beesley, J. L. Gilchrist, J. J. Spijkerman, and C. M. Yagnik 15 Jun. 1971 33 p refs
(Contract N00014-69-C-0401)
(AD-726742) Avail: NTIS CSCL 14/2

The feasibility of applying Moessbauer spectroscopy to non-destructive measurement of surface stresses in ferrous metals was examined. The concept is based on the small changes in Moessbauer spectra of ferrous metals under stress. The concept was first proved using the well-developed transmission geometry technique. The transition to back-scatter, which is essential for general use of the technique, called for a major effort for detector development. The effort finally paid off, with signal/noise per unit time fully 90% as good as is obtained in transmission. Further hard-ware development is required for a fully operational instrument, and there remain theoretical problems bearing on changes of steel alloy composition, the effects of surface roughness, and the stress distribution vs. depth.
Author (GRA)

N71-38720# Ballistic Research Labs., Aberdeen Proving Ground, Md.
BRLESC FINITE ELEMENT PROGRAM FOR AXISYMMETRIC PLANE STRAIN AND PLANE STRESS, ORTHOTROPIC SOLIDS WITH TEMPERATURE-DEPENDENT MATERIAL PROPERTIES
Stephen Gerard Sawyer Mar. 1971 144 p refs
(AD-727702; BRL-1539) Avail: NTIS CSCL 20/11

The report describes the latest finite element computer program coded in FORTRAN 4 to the BRLESC. A program was developed from SAAS 2 which has been written by the Aerospace Corporation for the stress analysis of axisymmetric aerospace structures. Eliminated were three of the five temporary tapes used in SAAS 2 because of technical difficulties in executing on the BRLESC in a program which utilizes more than two temporary tapes. To help interpretation of printed output plotting routines were incorporated which produce graphical output. This plotted output consists of a finite element grid for the solid, a deformed finite element grid in which the actual displacements are exaggerated, and contours of any component of stress or strain and of temperature. By incorporating the latest unpublished SAAS 2 revisions in the program additional capability to analyze solids in conditions of plane stress and plane strain is provided. To standardize the computation of nodal points for straight lines on the boundary of a solid, minor changes in the automatic mesh generation subroutine of SAAS 2 is made.
Author (GRA)

N71-38721# Naval Postgraduate School, Monterey, Calif.
WAVE FORCES ON A SUBMERGED HORIZONTAL CYLINDER
Frederick Conrad Schiller (M.S. Thesis) Jun. 1971 100 p refs
(AD-727691) Avail: NTIS CSCL 13/13

The oscillatory forces generated by the interaction of a train of gravity waves with a rigid horizontal circular cylinder located near a simulated ocean floor were determined experimentally. A circular cylinder of six inch diameter was subjected to gravity waves of wave lengths varying from 2 to 18 feet in a two-dimensional wave channel. Both the horizontal and vertical components of the hydrodynamic force were measured. Experimental results are plotted in dimensionless form. The horizontal and vertical dimensionless force coefficients are plotted as a function of the relative water depth, the relative wave length, and the relative wave height. Author (GRA)

N71-38722# Lehigh Univ., Bethlehem, Pa.
A METHOD FOR LARGE DEFLECTION INELASTIC ANALYSIS OF PLATE GRILLAGES UNDER NORMAL AND AXIAL LOADS
Robert P. Kerkot and Alexis Stapanko Jul. 1971 182 p refs
(Contract N00024-68-C-5242)
(AD-727601; FEL-323.5) Avail: NTIS CSCL 13/10

A method for analyzing plate grillages subjected to normal and axial loads was developed. Elasto-plastic range and large deformations are considered. The grillage equations were formulated from the general differential equations of plates and beams and a collocation type approach was employed for solving these equations. Due to the geometrical and material non-linearity of the problem it was necessary to employ a search technique in arriving at an answer. The feasibility of the method was

demonstrated by analyzing a rectangular plate and a plate grillage with two transverse and two longitudinal stiffening beams. Author (GRA)

N71-38723# New York Univ., N.Y. Courant Inst. of Mathematical Sciences.
PLATE ESTIMATES INVOLVING TWO STRAIN PARAMETERS
Chester B. Sensenig May 1971 94 p refs
(Contract N00014-67-A-0467-0014)
(AD-727604; IMM-388) Avail: NTIS CSCL 11/6

In this report estimates for the stresses and strains and their derivatives are derived for a thin plate. An isotropic material having a strain energy density function which is an analytic function of the strain invariants is considered, and the estimates are derived from the exact three dimensional theory of elasticity. These estimates are then used to derive approximate interior plate equations with error estimates. The estimates obtained are of the same type as those derived by F. John for shells, but the work here differs from that in that consideration is restricted to plates and two strain parameters are used rather than one. Author (GRA)

N71-38724# Brown Univ., Providence, R.I. Div. of Engineering.
OPTIMIZATION OF FINITE ELEMENT GRIDS BASED ON MINIMUM POTENTIAL ENERGY
Gregory M. McNeice and Pedro V. Marcal Jun. 1971 26 p refs
(Contract N00014-67-A-0191-0007)
(AD-727993; TR-7) Avail: NTIS CSCL 20/11

An initial study has been made of a method for optimizing finite element grids. This method is based on the minimum potential energy where th nodal point positions are also treated as independent variables. Necessary conditions have been obtained for the optimized grids. Case studies demonstrate the procedure for a one-dimensional tapered bar under axial load and for a two-dimensional square membrane subjected to a parabolic tensile stress. The optimized grids were observed to give improved stress estimates. Author (GRA)

N71-38725# Notre Dame Univ., Ind. Coll. of Engineering.
INELASTIC BUCKLING OF SHALLOW SPHERICAL SHELLS UNDER EXTERNAL PRESSURE
S. Sureshwara, L. H. N. Lee, and T. Ariman Jul. 1971 36 p refs
(Contract N00014-68-A-0152; Proj. Themis)
(AD-727819; THEMIS-UND-71-2) Avail: NTIS CSCL 13/10

In this paper the inelastic effect on the buckling load of a clamped shallow spherical shell subjected to an external pressure is investigated. A variational principle derived from a set of rate equilibrium equations and expressed in terms of Lagrangian variables is used to determine the critical pressure. This pressure is determined by a step-by-step numerical process based on a Rayleigh-Ritz technique. The spherical shell is idealized as a structure composed of four thin load-carrying layers of equal thickness and made of a work hardening material. The numerical results of the present analysis compare favorably with those of available experimental work. Author (GRA)

N71-38726# Virginia Polytechnic Inst., Blacksburg. Dept. of Engineering Mechanics.
SOLUTIONS FOR THE MULTILAYER TIMOSHENKO BEAM
Robert A. Heller and George W. Swift Aug. 1971 48 p refs
(Contract DAAF07-70-C-0444)
(AD-727640; VPI-E-71-12) Avail: NTIS CSCL 20/11

A second order solution is presented for sandwich beams consisting of an arbitrary number of midplane symmetrical layers subjected to any type of transverse and shear loading and bounded by any combinations of free, pinned, and clamped end conditions. The solution includes transverse shear deformation and is shown to be a very good approximation to exact elasticity solutions. The distributions of shear stresses, normal stresses, horizontal displacements, and transverse deflections have been computed for various beams and the pronounced deviations of these distributions from similare results using classical beam theory are explained. Author (GRA)

N71-38727# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DETERMINATION OF THE ENERGY DISSIPATION IN MATERIALS ASSOCIATED WITH STEADY-STATE RESONANCE OSCILLATIONS
V. N. Tyulenev 26 May 1971 47 p refs Transl. into ENGLISH from Sb. State. Prochnosti i Dinam. Aviats. Dvigatelei (USSR), no. 5, 1969 p 169-193
(AD-727458; FTD-HC-23-103-71) Avail: NTIS CSCL 21/5

A description is given of a method of studying the damping properties of machine element materials during tests on an electrodynamic vibrator. Energy dissipation can be determined by this method in specimens of materials and in machine elements of complex geometry for various vibration modes produced by the electrodynamic vibrator. The method is based on the determination of the energy absorption coefficient represented by a ratio of the energy dissipated in the element during one vibration cycle to maximum potential energy. This coefficient is obtained by measuring the ratio between the vibration amplitudes of the electrodynamic vibrator platform and the displacement amplitudes of a point on the specimen. The method is applied to steel and titanium specimens and to glass fiber reinforced plastic materials. GRA

N71-38728# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE CHARACTERISTICS OF DURABILITY OF TURBINE BLADES
L. V. Morozov 19 Mar. 1971 19 p refs Transl. into ENGLISH from Prochnost i Dinamika Aviats. Dvigatelei Sb. Statei (USSR), no. 5, 1969 p 91-102
(AD-727939; FTD-HT-23-37-71) Avail: NTIS CSCL 21/5

A theoretical and experimental study of the durability and fatigue behavior of turbine blades, both brand new and with various service times is given. A blade fatigue diagram is plotted from statistical test results for a large number of blades, assuming that the blade durability distribution follows a log normal law. The residual durability and its distribution are used as a basis for estimating the efficiency of used blades. The fatigue characteristics of a group of blades operated on a test stand for 20, 200, 500, 1000, 2300, 3200, and 4200 hr are discussed specifically. Author (GRA)

N71-38729# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DISPLACEMENTS OF A SPHERICAL SHELL DURING WELDING OF CIRCULAR JOINTS
V. M. Segalevich 12 Mar. 1971 21 p refs Transl. into ENGLISH from Moskovskoe Vysshee Tekhnicheskoe Uchilishche Trudy (USSR), no. 133, 1969 p 92-104
(AD-727943; FTD-HT-23-88-71) Avail: NTIS CSCL 13/13

The technique for calculation of thin spherical shell surface shift in welding of circular joints and results of the calculations were presented. Author (GRA)

N71-38730# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CALCULATION OF THE COEFFICIENT OF FRICTION DURING THE UPSETTING OF A SPECIMEN THROUGH A SOFT PACKING
E. A. Limberg 24 Jun. 1971 9 p refs Transl. into ENGLISH from Obrabotka Metallov Davleniem v Mashinostr. (USSR), no 5, 1969 p 32-34
(AD-727864; FTD-MT-24-71-71) Avail: NTIS CSCL 13/8

The paper deals with the initial stage in upsetting of a cylindrical specimen through packing made of a softer material. The velocity field in the packing material is determined as well

as the intensity of strain rates and the coefficient of rigidity. The law of distribution of radial flow velocities with respect to the thickness of the packing is taken as linear, and the friction stress, as in hydromechanics, is defined in terms of the coefficient of rigidity and the velocity gradient. An analytical expression is found for the coefficient of friction which contains the geometric parameters of the workpiece and the mechanical characteristics of the metals of the packing and the specimen.
Author (GRA)

N71-38731# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
STATICS OF THIN-WALLED SHELLS OF REVOLUTION
V. S. Chernina 18 Jun. 1971 509 p refs Transl. into ENGLISH of the book "Statika Tonkostennykh Obolochek Vrashcheniya" Moscow, Nauka, 1968 p 1-455
(AD-727859; FTD-MT-24-249-70) Avail: NTIS CSCL 20/11

The book is devoted to the theory and design of thin-walled shells of revolution. The basic equations of the theory are derived in an elementary form for a shell of revolution subjected to arbitrary loading. The deformations of cylindrical, conical, spherical, and toroidal shells are analyzed in detail under axisymmetrical and bending loads. The book is intended for design engineers and scientific workers engaged in designing machines and structures for strength.
Author (GRA)

N71-38732# Air Force Systems Command, Wright-Patterson AFB, Ohio.
THE STABILITY OF CONICAL AND SPHERICAL SANDWICH SHELLS
N. K. Galimov 5 Mar. 1971 14 p refs Transl. into ENGLISH from Sb. Issled. po Teorii Plastin i Obolochek (USSR), no. 4, 1966 p 184-194
(AD-727896; FTD-HT-23-82-71) Avail: NTIS CSCL 13/13

A system of stability equations in terms of a given stress function, deflection W, compressional and given shear functions, for an asymmetrical-structure conical sandwich shell with a compressible light-weight core are written, assuming an initial membrane-stress state, the core to be free of stresses, and the load to be distributed between the faces proportionally to their rigidities in compression, according to the work by N. K. Galinov and Kh. M. Mushtari (in the collection of articles 'Investigations in the plate and shell theory' no. 2 Kazan University, 1964, 35-47. Ref. 2h. Mekhanika, 1965, 9V36). The equations are simplified from the viewpoint of the local-stability theory. The obtained system of equations coincides with that for cylindrical shells with a reduced curvature radius. A formula is given for determining the axial buckling compression stress for a conical shell. The problem of the buckling of a truncated shell under uniform external pressure is solved by the Bubnov-Galerkin method. The solution of the problem of the buckling of spherical shell with a laterally isotropic light-weight core under external pressure is found by using the equations of the theory of shallow shells.
GRA

N71-38733# Lehigh Univ., Bethlehem, Pa. Center for the Application of Mathematics.
FINITE AXISYMMETRIC DEFORMATIONS OF INITIALLY CYLINDRICAL REINFORCED MEMBRANES
A. D. Kydoniefs Jun. 1971 18 p refs
(Contract N00014-67-A-0370-0001)
(AD-728022; CAM-100-13) Avail: NTIS CSCL 20/11

The axisymmetric deformations of an initially cylindrical membrane composed of an elastic, homogeneous, isotropic and incompressible material reinforced with a two-parameter system of perfectly flexible and inextensible helicoidal cords of variable pitch are considered. The undeformed configuration is determined so that the deformed membrane has a given axial section under specified internal pressure. The corresponding stress field and cord tensions are obtained. The solution given is exact and valid for the general form of the strain-energy function.
Author (GRA)

N71-38734*# AiResearch Mfg. Co., Los Angeles, Calif.
LOW-CYCLE FATIGUE EVALUATION FOR REGENERATIVELY COOLED PANELS
C. E. Richard, J. D. Duncan, C. Demogenes, and W. G. Flieder Washington NASA Oct. 1971 72 p refs
(Contract NAS1-50024)
(NASA-CR-1884; Rept-68-4313) Avail: NTIS CSCL 20K

Results of low cycle fatigue evaluations at room and elevated temperatures of Inconel 625 and Hastelloy X, brazed, plate-fin sandwiches suitable for regeneratively cooled structural panel applications are presented and compared with available theory. Also presented are results of supplemental parent metal tensile and fatigue tests.
Author

N71-38735 National Lending Library for Science and Technology, Boston Spa (England).
THE USE OF THE INDEX GRID IN ANALYSING COMPLEX DEFORMATION
L. P. Renne 12 May 1971 6 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Chern. Met. (Moscow), no. 1, 1971 p 110-112
(NLL-M-21007-(5828.4F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

A method is proposed for processing the results of deformation with an index grid which allows the intensity of deformation to be determined in a local zone at any stage of deformation.
Author

N71-38736 Colorado Univ., Boulder.
A CURVED CIRCULAR CYLINDRICAL SHELL FINITE ELEMENT FOR HIGHER ORDER SHELL THEORY
Adnan Mohamad Al-Adeeb (Ph.D. Thesis) 1969 215 p
Avail: Univ. Microfilms Order No. 70-5818

A curved element with four nodal points is developed. Five degrees of freedom are considered at each nodal point (three translations and two rotations). The element stiffness and mass matrices are derived, including transverse shear deformation as well as rotary inertia. Sufficient conditions for uniform convergence of the approximate displacement functions to their exact values are derived. A rectangular flat shell element is presented and a comparative study is made between the results of the curved and flat elements. Good results can be obtained by using a fairly coarse mesh in the case of curved elements, but a much finer mesh is required to obtain the same results with flat elements. The convergence properties with decreasing mesh size for both element types are studied. Numerical computation for examples of static and free vibration problems are presented.
Dissert. Abstr.

N71-38737 Louisiana State Univ., Baton Rouge.
UNCOUPLED QUASI-STATIC THERMOELASTIC SOLUTIONS FOR THE SEMI-INFINITE AND CIRCULAR PLATES WITH AN ECCENTRIC HOLE
Robert Arthur Smith (Ph.D. Thesis) 1969 126 p
Avail: Univ. Microfilms Order No. 70-9091

Cryogenic, nuclear, frictional, solar and outer space heating or cooling introduce a further complexity to equipment design. A method is developed to determine the temperatures and corresponding thermal stress distributions in three basic geometric configurations. They are the circular plate with a concentric or eccentric circular hole and the semi-infinite plate with a hole at an arbitrary distance from the plate edge. The temperature distributions corresponding to each stress profile are included to make stresses applicable to a variety of heating conditions. It is shown that transient stresses can be greater than the steady state values and that stresses increase as the relative hole size decrease.
Dissert. Abstr.

N71-38738 Wisconsin Univ., Madison.
OPTIMUM DESIGN OF DISCS AND SHELLS SUBJECTED TO PRESSURE AND INERTIAL FORCES
Karan Singh Surana (Ph.D. Thesis) 1970 378 p

Avail: Univ. Microfilms Order No. 70-13939

The formulation of the disc and shell problems for automated design is investigated. Variable geometry rotating discs with and without central holes, press fitted compound cylinders, hemispherical shells with nozzles and cylinders subjected to a band of uniform displacements are considered from the design view point. Design procedures and data are given for all the cases. Simplified analytical methods are generally used for parameter selection. A three dimensional finite difference method is then applied to provide a check on the degree of accuracy of the final design. This approach gives adequate and economical design procedures for the class of problems under consideration. Dissert. Abstr.

N71-37816# Joint Publications Research Service, Washington, D.C.
ANALYSIS OF STRUCTURAL STRENGTH OF THE SHELL OF A THERAPEUTIC PRESSURE CHAMBER BUILT OF ORTHOTROPIC TWO-PLY FIBER GLASS
I. Ye. Baranik et al *In its* Develop. in pressure Chamber Technol. 1 Oct. 1971 p 1-4 (See N71-37815 24-11)
Avail: NTIS

33 THERMODYNAMICS AND COMBUSTION

Includes ablation, cooling, heating, heat transfer, thermal balance, and other thermal effects; and combustion theory. For related information see also: 12 Fluid Mechanics; and 27 Propellants.

N71-38739# Atomic Energy Establishment, Cairo (Egypt). Reactors Dept.
EXPERIMENTAL LOOP FOR TWO PHASE HEAT TRANSFER INVESTIGATIONS
M. F. El-Fouly and M. S. Khattab 1969 50 p refs
(UARAEE-81) Avail: AEC Depository Libraries

An experimental heat transfer loop was designed, manufactured, and erected for investigations of two phase heat transfer in a simulated BWR fuel channel. The test section, equipment, test procedures, measurements, and the experimental method for analysis are described. Recommendations for future works are listed. Author (NSA)

N71-38740# Comitato Nazionale per l'Energia Nucleare, Casaccia (Italy). Centro di Studi Nucleari.
HEAT EXCHANGE IN POST BURNOUT. 1: THEORETICAL CONSIDERATIONS ON COOLING IN POST BURNOUT. 2: DEPENDENCE OF HEAT EXCHANGE ON THE STATE OF TWO-PHASE MIXTURES IN THE POST-BURNOUT REGIME [SULLO SCAMBIO TERMICO IN ULTRACRISI. 1: CONSIDERAZIONI TEORICHE SULLA REFRIGERAZIONE IN ULTRACRISI. 2: SULLAR DIPENDENZA DELLO SCAMBIO TERMICO DAL TITOLO PER MISCELE BIFASI IN REGIME DI ULTRACRISI]
R. Brevi and M. Cumo 12 Nov. 1970 62 p refs In ITALIAN
(RT/ING-(70)27) Avail: AEC Depository Libraries

Some experimental results obtained at CISE are reported. These results refer to temperature measurement of heating wall cooled, under post-burnout conditions, by a steam-water mixture flowing upwards in a tubular channel at 70 kg sq cm pressure and 220 g sq cm sec specific mass flow. In the post-burnout the thermal flux is removed partly from the liquid phase and partly from the steam phase. The heat flux removed from steam is expressed by the product of the mixture-wall temperature stage and of an exchange coefficient which is a linear function of the quality. The thermal flux removed by the liquid is directly proportional to the liquid quality. Author (NSA)

N71-38741*# Case Western Reserve Univ., Cleveland, Ohio. Div. of Fluid, Thermal and Aerospace Sciences.
NEW HALF-RANGE DIFFERENTIAL APPROXIMATION FOR SPHERICALLY-SYMMETRIC RADIATIVE TRANSFER
James B. Moreno (Sandia Corp.) and Isaac Greber Feb. 1971 43 p refs Supported in part by AEC
(Grant NGR-36-003-064)
(NASA-CR-123198; FTAS/TR-71-57) Avail: NTIS CSCL 20M

A half-range differential approximation for radiative transfer with spherical symmetry is presented. The approach represents a modification of the four-moment double spherical-harmonics method, to which it reduces in the planar limit. The difference is effected by relocating the discontinuity of the assumed directional distribution of radiation intensity. The shift takes the discontinuity from precisely on the division between radially inward and radially outward, to just within the radially - outward directional half range. The method is tested on a variety of concentric sphere problems with and without internal heat sources, reproducing all the important features of the exact results. Over the range of problems treated, the method is shown to be more uniformly successful than any of the other approximations considered. Author

N71-38742*# McDonnell-Douglas Astronautics Co., St. Louis, Mo. Materials and Processes Dept.
HIGH TEMPERATURE INSULATION MATERIALS FOR RERADIATIVE THERMAL PROTECTION SYSTEMS (TPS)
T. A. Hughes 10 Aug. 1971 93 p refs
(Contract NAS8-26115)
(NASA-CR-119950; MDC-E0449) Avail: NTIS CSCL 20M

Results are presented of a program to evaluate thermal insulations for use under a radiative TPS of a shuttle orbiter vehicle. Evaluations were made for survival under the multimission requirements of shuttle acoustic/vibration loads and thermal profiles with peak temperatures of 1800 F and 2200 F. A total of 1100 specimen-cycles were completed using metal foil packaged refractory fiber insulations. Author

N71-38743*# Aerojet-General Corp., Azusa, Calif. Power Systems Div.
PCS-1 TESTING, MARCH - MAY 1970
J. N. Hodgson 4 Aug. 1970 104 p refs
(Contract NAS3-13459)
(NASA-CR-72917; AGC-TM-7992:70-633) Avail: NTIS CSCL 20M

The testing performed in PCS-1 during the time period of 12 March through 28 May 1970 is reported. Operation consisted of 28 runs with a total running time (based on mercury loop operation) of 1,620 hours 15 minutes. The conclusion of testing brought the accrued operating time of several components into the range of 12,000-14,000 hours. Most significant is the turbine alternator assembly (TAA) which has now operated for 12,443 hours. The PCS-1 Test Plan outlines various tests of both system and component orientation. These tests were all successfully completed. Additional tests were added near the end of the test period to investigate boiler performance and system response to condenser-overpressure shutdowns. Each of the testing phases is summarized. Author

N71-38744*# Aerojet-General Corp., Sacramento, Calif. Power Systems Div.
MATHEMATICAL CORRELATION OF OBSERVED CONDENSER HEAT TRANSFER VARIATIONS
J. N. Hodgson 21 May 1970 39 p refs
(Contract NAS3-13458)
(NASA-CR-72911; AGC-TM-7994:70-621) Avail: NTIS CSCL 20M

A mathematical model has been developed for the SNAP-8 condenser which includes the effects of both transfer and pressure drop. The model identifies a substantial loss of temperature potential at certain operating conditions, and accounts for the loss of apparent heat transfer capability observed in condenser testing. Author

N71-38745*# Aerojet Liquid Rocket Co., Sacramento, Calif.
HEAT PIPE TECHNOLOGY FOR ADVANCED ROCKET THRUST CHAMBERS Final Report
D. C. Rouser 15 Jul. 1971 229 p refs
(Contract NAS7-697)
(NASA-CR-123117; Rept-697-F) Avail: NTIS CSCL 20M

Adaptation of the heat pipe principle to the cooling of rocket engine thrust chambers was evaluated. A regeneratively cooled concept was chosen. Advanced design analysis, preliminary thrust chamber design, and injector design and fabrication are discussed. An evaporator wick was developed. K.P.D.

N71-38746*# Princeton Univ., N.J.
THEORETICAL INVESTIGATION ON TRANSVERSE MODE COMBUSTION INSTABILITY FOR LIQUID PROPELLANT ROCKETS
Jean H. Lorenzetto and Luigi Crocco Sep. 1971 63 p refs
(Grant NGL-31-001-155)
(NASA-CR-120781; AMS-987) Avail: NTIS CSCL 21B

A mathematical approach is described which provides an analytical solution to the problem of nonlinear transverse combustion instability in a thin annular liquid propellant rocket chamber. Finite chamber lengths are considered as well as a time dependency on the droplet lifetime. Boundary conditions existing at the injector and nozzle eliminate the restrictions of holding mass, energy, and momentum constant with time. A numerical integration of the waveshape equation and employing the Priem-Heidmann droplet evaporation model results in a shock-type periodic solution. Threshold limits corresponding to triggering instability as well as limiting-cycle behavior are found using this approach. It is concluded that: (1) the combustion should either be spread over the entire length of the combustor or completed in less than 20% of chamber length for the example cited, (2) the chamber length should be as small as possible compared to the mean annulus circumference, and (3) the ratio of nozzle entrance to injected velocity should be maximized by injecting the propellant at the lowest velocity and increasing the chamber Mach number. Author

N71-38747*# Louisiana State Univ., Baton Rouge. Reacting Fluids Lab.
THERMODYNAMIC PROPERTIES IN POLYNOMIAL FORM FOR CARBON, HYDROGEN, NITROGEN, AND OXYGEN SYSTEMS FROM 300 TO 15000 K
D. D. Esch, A. Siripong, and R. W. Pike 15 Nov. 1970 48 p refs
(Grant NGR-19-001-059)
(NASA-CR-111989; NASA-RFL-TR-70-3) Avail: NTIS CSCL 20M

Thermodynamic properties of carbon, hydrogen, nitrogen, and oxygen compounds as well as selected inerts (neon, argon and helium) are fitted to general polynomial forms over the following temperature ranges: 300 to 1000 K, 1000 to 6000 K, and 6000 to 15000 K. A reference state of 298.16 K and 1.0 atmosphere was chosen with H2, N2, O2, Ne, Ar, He, C (solid) and e(-) as reference elements. Seven coefficients are tabulated for each of the 99 species considered and for each temperature range of interest. Author

N71-38748*# Arizona State Univ., Tempe. Dept. of Mechanical Engineering.
HEAT TRANSFER BETWEEN SURFACES IN CONTACT: AN ANALYTICAL AND EXPERIMENTAL STUDY OF THERMAL CONTACT RESISTANCE OF METALLIC INTERFACES
L. S. Fletcher (Rutgers Univ.) and D. A. Gyorog (Missouri Univ., Rolla) May 1971 192 p refs Revised
(Grant NGR-03-001-033)
(NASA-CR-114373; ME-TR-033-4-Rev) Avail: NTIS CSCL 20M

A new dimensionless correlation for the prediction of thermal contact resistance between similar metal surfaces in a vacuum environment was developed in terms of known engineering measurements. This expression was formulated from the results of an experimental investigation using aluminum, brass, stainless steel, and magnesium, with a wide range of test variables. The dimensionless parameters for this expression correlated the experimental data of this investigation and published data within an average overall rms error of 24 percent or less for most of the data. These experimental data included mean junction temperatures of -250 F to 500 F, apparent interface pressures of 10 to 7,000 psi, surface flatness deviations of 15 to 4,500 microinches, and surface roughnesses of 3 to 120 microinches. Author

N71-38749*# Purdue Univ., Lafayette, Ind. School of Mechanical Engineering.
APPLICATION OF ABLATION TO A HIGH CHAMBER PRESSURE ROCKET ENGINE
A. W. Bracheisen and C. M. Ehresman 9 Nov. 1971 22 p refs
(Grant NGR-15-005-069)
(NASA-CR-120798) Avail: NTIS CSCL 11B

Ablation cooling was successfully used in a rocket engine at a nominal chamber pressure of 4000 psia. Both the chamber liner and the nozzle were constructed of a silica phenolic ablative material. Linear ablation rates at the nozzle throat for thirty-six firings were computed from run data. The overall average rate obtained was 0.0661 in/sec. The linear ablation rate obtained for the chamber liner was 0.071 in/sec at the nozzle entrance end. Author

N71-38750*# Rocketdyne, Canoga Park, Calif.
ANALYSIS OF THE WAVE MOTION IN BAFFLED COMBUSTION CHAMBERS Technical Report, period ending 31 Dec. 1970
C. L. Oberg, W. H. Evers, and T. L. Wong Oct. 1971 127 p refs
(Contract NAS3-11226)
(NASA-CR-72879; R-8758) Avail: NTIS CSCL 20M

Analytical methods have been developed to predict the wave motion in baffled combustion chambers. Principally, the method involves of the wave equation through use of antiserative/variational method. Calculated results are in good agreement with available data from bench scale acoustic models. Convergence of series expressions which occur in the analysis and of the iteration scheme was demonstrated numerically. Calculated results with gain/loss end-wall boundary conditions do not agree with observed engine stability, which indicates that other gain/loss representations must be used. Author

N71-38751# Sandia Corp., Albuquerque, N.Mex.
ENERGY DIFFUSION IN A ONE DIMENSIONAL FINITE SOLID WITH LINEAR HEAT LOSS
A. B. Donaldson Feb. 1971 80 p refs
(SC-DR-70-767) Avail: NTIS

Solutions are obtained which describe the transient temperature distribution in a one-dimensional solid with linear heat loss. The forcing function is an initial step in temperature over some fraction of the solid. Both rectangular and circular geometries are considered with either heat sink or insulated boundaries. Author

N71-38752# Linde Div., Union Carbide Corp., Indianapolis, Ind.
THERMAL INSULATION STUDY, PHASE 2 Final Report, Sep. 1967 - Sep. 1970
W. E. Grunst, H. Marthens, F. Notaro, D. J. Webster, and R. Zawleriche May 1971 371 p refs
(Contract AT(29-2)-2832)
(ALO-2832-43) Avail: NTIS HC $9.00/MF $0.95

Flat plate testing was utilized to obtain experimental thermal conductivity data for several multilayer insulations spanning service temperature ranges from 500 to 2500 F and layer density ranges corresponding to 0 to 18psi compressive loadings. Effective thermal conductivity in the lateral or longitudinal direction are also presented for several nonfoil multilayer insulations. Several multilayer insulation systems were

evaluated to determine thermal performance stability over extended operating periods (2000 to 10,000 hours) at maximum service temperatures. Prior to the stability operating period, effective thermal conductivity data for the installed insulation configuration were determined at several different temperature levels. The effect of the presence of a penetration through an insulation panel on the simulation thermal performance was determined for the case when the penetration and/or its immediate surroundings give rise to thermal discontinuities. For flush penetrations and extended penetrations, zero gap, open gap and filled gap configurations are analyzed. Author (NSA)

N71-38753# Los Alamos Scientific Lab., N.Mex.
THERMODYNAMIC PROPERTIES OF PuFe2 FROM EMF MEASUREMENTS
George M. Campbell Jan. 1971 4 p refs
(Contract W-7405-eng-36)
(LA-4638) Avail: NTIS

The free energy of formation of PuFe2 was measured over the temperature range 792 to 1106 K by monitoring the emf of the cell Pu(s,l)/PuCl3, LiCl-KCl/PuFe2 + Fe(s). Transient potential methods were used to ensure reversibility and singularity of the electrode reactions. Sufficient precision was obtained to permit the calculation of thermodynamic and thermal functions at the temperature of the measurements and to make extrapolated estimates at lower temperatures. Author (NSA)

N71-38754# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Besktorentwicklung.
EXPERIMENTAL INVESTIGATION OF THE RETARDATION OF BOILING OF SODIUM ON ARTIFICIALLY ROUGHENED SURFACES [EXPERIMENTELLE UNTERSUCHING DES SIEDEVERZUGES VON NATRIUM AN KUENSTLICHEN OBERFLAECHENRAUHIGKEITEN]
G. F. Schultheiss Dec. 1970 100 p refs In GERMAN; ENGLISH summary
(KFK-1332) Avail: AEC Depository Libraries

Results of investigations of thermohydraulic and physico-chemical influences on incipient boiling superheat of sodium are reported. The geometry of cylindrical type artificial cavities was varied in depth and diameter. The sodium oxide concentration was varied and controlled by means of the cold trap temperature. All cavities tested were found to be extremely stable nucleation centers for months. They were not inactivated either by pressurization or by longtime boiling. Decreasing of depth to diameter ratio slightly increases the incipient boiling superheat. The incipient boiling superheat depends on oxide concentration as well as on the test-surface material. For stainless steel superheat has a typical maximum at about 127 C cold trap temperature - corresponding to 2ppM Na2O - caused by the chromium content. Pure iron and nickel did not show such a maximum. Pure chromium behaves like stainless steel. Pure iron shows generally very small superheat not influenced by oxide concentration. NSA

N71-38755# Israel Program for Scientific Translations, Ltd., Jerusalem.
THERMOPHYSICAL PROPERTIES OF AIR AND AIR COMPONENTS
A. A. Vasserman et al 1971 393 p refs Transl. into ENGLISH of the book "Teplofizicheskie Svoistva Vozdukha i Ego Komponentov" Moscow, Nauka, 1966 Sponsored by NBS and NSF
(TT70-50095) Avail: NTIS HC $6.00/MF $0.95

A method is described for deriving equations of state from elementary functions conforming to experimental thermodynamic data. The equations of state constructed by this method are used for computing the thermal and thermodynamic values. A critical analysis is given of the available data on the thermal properties of air, nitrogen, oxygen, and argon. The equations of state for these gases are determined, and detailed tables of their thermodynamic properties are compiled for conditions ranging from the saturation curve to temperatures of 1300 K and pressures of 1000 bar. The t-s and i-s diagrams are given for each gas. The experimental data on the viscosity and thermal conductivity of air and its components are analyzed and generalized, and equations are given for computing these properites over a wide range of parameters. Author

N71-38756# Israel Program for Scientific Translations, Ltd., Jerusalem.
THERMODYNAMIC AND THERMOPHYSICAL PROPERTIES OF HELIUM
N. V. Tsederberg et al 1971 260 p refs Transl. into ENGLISH of the publ. "Termodinamicheskie i Teplofizicheskie Svoistva Geliya" Moscow, Atomizdat, 1969 Sponsored by NBS and NSF
(TT70-50096) Avail: NTIS

The application of helium as a working substance or heat carrier in nuclear power plants was investigated, and comprehensive tables of the thermodynamic and thermophysical properties of helium in the ranges of pressure from 0.2 to 200 bar and of temperature from 0 to 3000 C were compiled. An equation of state for helium is given, and the thermal properties are calculated. By means of the rules of statistical thermodynamics, the specific heat, enthalpy, and entropy of helium in the perfect gas state were calculated. The influence of the real state of a gas on the thermodynamic properties was estimated from the equation of state for helium. The i-s diagram was constructed. Equations were formulated for describing the thermal conductivity and the viscosity of helium is given temperature and pressure ranges. Author

N71-38757# Israel Program for Scientific Translations, Ltd., Jerusalem.
HEAVY WATER: THERMOPHYSICAL PROPERTIES
Ya. Z. Kazavchinskii et al 1971 270 p refs Transl. into ENGLISH of the book "Tyazhelaya Voda: Teplofizicheskie Svoistva" Moscow, Gos. Energ. izd., 1963 Sponsored by NBS and NSF
(TT70-50094) Avail: NTIS

A review, a critical analysis, and a synopsis of literature published on the thermophysical properties of heavy water are submitted. This material served to derive equations of state for heavy water and its vapor. These equations form the basis of the comprehensive tables on thermodynamic properties of heavy water for pressures of up to 500 kg/sq cm and a temperature range between 3.8 and 550 C which are included. Author

N71-38758*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AERODYNAMIC HEATING AT MACH 8 OF ATTACHED INFLATABLE DECELERATOR CONFIGURATIONS
Theodore R. Creel, Jr. and Robert Miserentino Washington Oct. 1971 78 p refs
(NASA-TM-X-2355; L-7864) Avail: NTIS CSCL 20M

Heat transfer coefficients on four attached inflatable decelerator (AID) configurations were obtained in a Mach 8 variable-density tunnel at angles of attack of 0, 5, and 10 deg for a Reynolds number range of 220,000 to 1,230,000 in air. A fusible-temperature-indicator technique which employs a temperature-sensitive material that changes from an opaque solid to a clear liquid at a known temperature was used to obtain these coefficients. The results of this investigation indicate that the heat transfer coefficients on the ram-air inlets and the burble fence are up to five times larger than the coefficients at identical locations on a smooth AID body. Moving the ram-air inlets rearward reduces the heating rates immediately behind the aft row of inlets. This placement of the inlets also increases the heating rate on the burble fence. Increasing Reynolds number resulted in an increase in heat transfer coefficient primarily on the burble fence. Author

N71-38759# Cincinnati Univ., Ohio. Dept. of Aerospace Engineering.
HEAT TRANSFER BY A MULTIPLE ARRAY OF ROUND

JETS IMPINGING PERPENDICULAR TO A CONCAVE SURFACE
W. Tabakoff, R. Panri, and W. Clevenger Jun. 1971 48 p refs
(Contract DAHC04-69-C-0016; Proj. Themis)
(AD-727730; THEMIS-AE-71-20; AROD-T-4-34-E) Avail: NTIS CSCL 20/13

An experimental investigation was undertaken to study jet impingement cooling of a semi-cylindrical concave surface in a semi-enclosed environment. The investigation showed that it was possible to obtain a correlating formula for the various parameters involved. The effect of jet (spent air) on heat transfer was also observed. The results are compared with those of Kercher and Tabakoff who carried out a similar investigation using a flat plate. Author (GRA)

N71-38760# Curtiss-Wright Corp., Wood-Ridge, N.J.
EXPLORATORY DEVELOPMENT PROGRAM ON THE ROTATING COMBUSTION ENGINE USING THE RC1-90 TEST RIG
C. Jones, H. Lamping, and H. R. Corwin Jan. 1971 15 p refs
(Contract N00019-70-C-0371)
(AD-727745; CW-WR-70-052.S) Avail: NTIS CSCL 21/2

The report covers additional testing of the stratified charge RC-90 engine to explore its exhaust emission characteristics plus a brief evaluation of the Texaco ignition system. Author (GRA)

N71-38761# George Washington Univ., Washington, D.C.
THEORETICAL LIMITATION ON INFORMATION RETRIEVAL FROM PHYSICAL AND COMMUNICATION SYSTEMS BY REPEATED PRECISE MEASUREMENTS
Robert A. Johns and Robert B. Heller Jun. 1971 31 p refs
(Contract N00014-67-A-0214-0003)
(AD-727788) Avail: NTIS CSCL 09/4

The report discusses a theoretical limitation on the ability to communicate over a channel (or obtain information about a physical system) due to accumulated entropy associated with irreversible thermodynamic processes (measurement of the signals used to transmit information). This increasing uncertainty is shown to cause the transinformation to be a decreasing function as the number of observations increases. Author (GRA)

N71-38762# Tennessee Univ., Knoxville. Dept. of Mechanical and Aerospace Engineering.
INVESTIGATION OF THE EFFECTS OF CAPILLARY GROOVES ON SURFACE WETTING AND EVAPORATION
Final Report
Reinhard G. Bressler 1 Jul. 1971 41 p refs
(Contract Nonr-4289(02))
(AD-727200) Avail: NTIS CSCL 20/13

The static and dynamic rise of a liquid phase was examined experimentally and theoretically in capillary grooves of square, semicircular and triangular cross sections. In static equilibrium, the wetting characteristics are described in terms of a fully-wetted height which can be predicted for given physical properties from an equivalent capillary radius. Results of experimental measurements and numerical computations are in fair agreement with the proposed prediction method. For the dynamic rise, an attempt was made to obtain expressions which approximately predict heat-transfer rates in order to select for given properties and temperature differences a groove of optimum design. Liquid flow rates in capillary grooves were measured by means of a forced-convection mass-transfer equipment based on the wetted-wall column principle. The results are studied for agreement with predictions computed for evaporation heat-transfer and related to mass-transfer by using Reynolds analogy for pipe flow. Author (GRA)

N71-38763# Notre Dame Univ., Ind. Coll. of Engineering.
LAMINAR FREE CONVECTION FROM A NONISOTHERMAL PLATE IMMERSED IN A TEMPERATURE STRATIFIED MEDIUM
K. T. Yang, J. L. Novotny, and Y. S. Cheng Jun. 1971 40 p refs
(Contract N00014-68-A-0152; Proj. Themis)
(AD-727204; THEMIS-UND-71-1) Avail: NTIS CSCL 20/3

The study deals with natural convection heat transfer from a nonisothermal vertical flat plate immersed in a temperature stratified environment. Extensive numerical calculations based on similarity solutions have been carried out for a wide range of wall and ambient temperature distributions for Prandtl numbers between 0.1 and 20. The limiting cases of the Prandtl number approaching zero and infinity have also been considered. The relative effect of the individual temperature distributions is discussed in detail. The flow reversal and temperature defect behavior found in other investigations dealing with nonuniform ambient temperatures is closely examined. It is also shown that approximations based on the local temperature difference are not adequate for predicting surface heat transfer rates.
Author (GRA)

N71-38764# Army Foreign Science and Technology Center, Charlottesville, Va.
TEMPERATURE STRESSES IN THIN VISCOELASTIC PLATES WITH HEAT TRANSFER [TEMPERATURNYE NAPRYAZHENIYA V TONKIKH VYAZKOUPRUGIKH PLASTINKAKH S TEPLOOBMENOM]
Yu. M. Kolyano et al 17 Jun. 1971 16 p refs Transl. into ENGLISH from Inzh-Fiz. Zh. (Moscow), v. 17, no. 5, 1969 p 892-899
(AD-727948; FSTC-HT-23-873-71) Avail: NTIS CSCL 13/13

Quasi-static problem of thermal visco-elasticity is solved for an infinite plate with heat transfer heated by a concentrated heat source, and dynamic problem of thermal visco-elasticity is solved for a semi-infinite plate with heat transfer suddenly heated on the edge. GRA

N71-38765*# Louisiana State Univ., Baton Rouge.
ON CHEMICAL REACTIONS IN THE CHAR ZONE DURING ABLATION
G. C. April, R. W. Pike, and E. G. Del Valle Washington NASA Oct. 1971 64 p refs
(Grant NGR-19-001-016)
(NASA-CR-1903) Avail: NTIS CSCL 20M

The reacting flow of pyrolysis products through the char layer of low density, nylon phenolic resin, charring ablators and through porous graphite was studied experimentally and theoretically. It was found that a finite rate, reacting flow model is necessary to accurately describe the phenomena within char. The reaction kinetics for a temperature range of 600 F to 3000 F with experimental simulation to 2300 F were determined and incorporated into a mathematical model. This model, in conjunction with experimental results, was used to show the limitation of frozen and equilibrium flow in predicting the behavior within the char layer. In addition, radioactive tracer studies using carbon-14 were conducted to determine carbon deposition and product distributions within the char. In general, deposition was greatest near the front surface where the temperature varied between 1800 - 2300 F. A bromine homogeneous gas phase catalyst was investigated as a means of increasing the energy absorption by chemical reactions. Excellent activity was observed. The temperature at which reactions started decreased from 1900 F to 1500 F. This effect was measured by comparing the experimental exit gas compositions with compositions calculated by the non-equilibrium flow model using conventional kinetic data. Heterogeneous catalysts (molybdenum and tungsten) had essentially no effect on chemical reactions in the char. Author

N71-38766*# Avco Corp., Wilmington, Mass. Systems Div.
AN EXPERIMENTAL INVESTIGATION OF BASE HEATING ON TYPICAL MARS ENTRY BODY SHAPES
O. L. Zappa and W. G. Reinecke Washington NASA Nov. 1971 84 p refs
(Contract NAS1-9368)
(NASA-CR-1920) Avail: NTIS CSCL 20M

Hypersonic experiments on wire supported high angle blunt

cones were conducted to determine the base heating characteristics. Heating distributions were obtained for several base configurations with variations in free stream Reynolds Number and gas composition. The dependence of the heating in the base region at angle of attack was also investigated. It was found that gas composition effects can be accounted for by comparison at equal Reynolds Number. Angle of attack effects can result in either increasing or decreasing base heating depending upon the location in the base region. Author

N71-38767*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PERFORMANCE OF A MODULAR COMBUSTOR DESIGNED FOR A VTOL TIP-TURBINE LIFT FAN
Nicholas R. Marchionna Washington Nov. 1971 18 p refs
(NASA-TN-D-6542; E-6441) Avail: NTIS CSCL 20M

An array of 16 swirl-can modules was tested with liquid ASTM A-1 fuel in a 10.75-in. diameter circular duct at conditions simulating the design operating point of a combustor for a 10,000-lbf thrust VTOL lift engine with an inlet air temperature of 600 F, an inlet total pressure of 111 psia, and a reference velocity of 165 ft/sec. Performance of flat plate and conical flame holders were compared for combustion efficiency, total pressure loss, and pattern factor. At the design operating point requiring an exhaust gas temperature of 1440 F, combustion efficiency was close to 100 percent for all models tested. The flat plate flame holders gave better exhaust gas temperature profile characteristics than the conical flame holders. With a burning length of 18 in., the pattern factor was 0.38 and the total-pressure loss was 5.1 percent. Author

N71-38768*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECT OF SUBLIMATION ON THE BEHAVIOR OF CRYODEPOSITS
J. Perry Campbell Washington Nov. 1971 22 p refs
(NASA-TN-D-6540; E-6461) Avail: NTIS CSCL 20M

The rates of energy loss due to sublimation have been calculated for water, carbon dioxide, argon, krypton, xenon, and oxygen over the temperature range in which these materials are solids and have vapor pressures of less than 1 torr. These energy losses are compared with the possible thermal radiation losses of such deposits in the same temperature range. The energy loss rate from these cryodeposits due to sublimation is quite sensitive to the surface temperature of the deposit. There is only a narrow temperature range over which the sublimation and radiation energy losses are of the same magnitude and in which both phenomena must be considered in a heat balance. At temperature above this range, sublimation is the dominant energy-loss mechanism; at lower temperatures the radiation energy loss is the more important. The surface temperature, mass loss, and deposit lifetime of a subliming cryodeposit, both with and without an incident energy heat load, are evaluated. Numerical results are given for a typical ice cryodeposit, both with and without an incident energy heat load from a 300 K blackbody, for substrate temperatures ranging from 190 to 270 K, and for deposit thicknesses ranging from 10 to 1 cm. Author

N71-38769# Massachusetts Inst. of Tech., Cambridge. Fluid Mechanics Lab.
THE AUTOMOTIVE GAS TURBINE AND NITRIC OXIDE EMISSIONS
Thomas Mikus and John B. Heywood Jun. 1971 30 p refs
(Grant NSF GK-15409)
(FML-Publ-71-11) Avail: NTIS

A model for the formation of nitric oxide, NO, in regenerative automotive gas turbine engines is presented. The model is shown to closely predict relative NO emission trends for an existing engine, while predicting absolute levels within a factor of 2. A typical near future automotive turbine cycle is then described. Engine performance and NO emissions are calculated for this cycle. The trade-off between fuel consumption and NO emissions for conventional combustor design is presented as a function of turbine inlet temperature. The methods by which NO emissions can be reduced are examined, and it is found that to meet the proposed 1976 Federal Emissions Standard for NO(x), the combustor's primary zone must be made considerably leaner and more homogeneous than is typical of current combustor designs. Author

N71-38770 National Lending Library for Science and Technology, Boston Spa (England).
HEAT TRANSFER IN SMOOTH TUBES, BETWEEN PARALLEL PLATES, IN ANNULI AND TUBE BUNDLES WITH EXPONENTIAL HEAT FLUX DISTRIBUTIONS IN FORCED LAMINAR OR TURBULENT FLOW [DER WAERMENEBERGANG IN GLATTEN ROHREN, ZWISCHEN ARALLELEN PLATTEN, IN RINGSPALTEN UND LAENGS ROHRBUENDELN BEI EXPONENTIELLER WAERMEFLUSS-VERTEILUNG IN ERZWUNGENER LAMINARER ODER TURBULENTER STROEMUNG]
H. Graeber (CEN, Saclay, France) 1 Jun. 1971 41 p refs
Transl. into ENGLISH from Int. J. Heat Mass Transfer (England), v. 13, no. 11, Nov. 1970 p 1645-1701
(NLL-Windscale-458-(9091.9F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 10 NLL photocopy coupons

By introducing an additional parameter F sub o, the processes known hitherto for calculating heat transfer are extended to the heat flux distributions which give a heat transfer coefficient independent of position downstream of the thermal and hydraulic stabilization regions. The equations for the explicit calculation of temperature field are given for the annular space, as well as the Nusselt number in laminar flow and constant heat flux, the heat transfer taking place on one wall or both. The results of the numerical calculation carried out with an IBM-7094 computer are given in the tables and diagrams for an extended range of the various parameters and compared with the experimental results: distribution of velocity, temperature and heat flux density normal to the wall, Nusselt number and mean temperature. A simple process to determine the lower limit of the thermal entry length is described. Author

N71-38771 National Lending Library for Science and Technology, Boston Spa (England).
EXPERIMENTAL INVESTIGATION OF THE HEAT TRANSFER IN TUBE BUNDLES WITH TURBULENT FLOW PARALLEL TO THE AXIS AT CONSTANT HEAT FLUX DENSITY IN THE REGION OF AVERAGE PRANDTL NUMBERS [EXPERIMENTELLE UNTERSUCHUNG DES WAERMEUEBERGANGS IN PARALLEL DUCHSTROEMTEN ROHRBUENDELN BEI KONSTANTER WAERMESTROM-DICHTE IM BEREICH MITTLERER DRANDTL-ZAHLEN)
M. Rieger (CEN, Saclay, France) 23 Jun. 1971 31 p refs
Transl. into ENGLISH from Int. J. Heat Mass Transfer (England), no. 12, 1969 p 1421-1447
(NLL-Min-Tech-T-6697-(5809.95)) Avail: Natl. Lending Library, Boston Spa, Engl.: 6 NLL photocopy coupons

The heat-transfer parameters were determined experimentally in electrically heated tube bundles for turbulent flow parallel to the axis. The tubes were arranged in a pattern of equilateral triangles. The ratios of the distance between the axes of the tubes to their external diameter were 1.60 and 1.25. The heat flux at the surface of the surface of the tubes was about 10 W/sq cm. The wall temperatures in the bundle were measured directly with thermocouples which were embedded in the surfaces. The points of temperature measurements were chosen at numerous positions in the lateral cross-section and permitted measurement of the mean and local heat transfer coefficients in the tube bundle. The experiments were carried out with distilled water and with a mixture of 60% ethylene glycol and 40% water. The values obtained for the Prandtl numbers fell within the range from 2.3 to 18. The relation between the mean heat-transfer coefficients and the friction factor in the tube bundles was found. Author

N71-38772 National Lending Library for Science and Technology, Boston Spa (England).
CRYSTALLIZATION FROM SOLUTIONS
V. I. Subbotin et al 28 Jul. 1971 20 p refs Transl. into ENGLISH from the book "Physico-Chemical Fundamentals of the Use of Liquid Metal Coolants" Atomizdat, 1970 p 41-50
(NLL-Risley-Trans-2168-(9091.9F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 2 NLL photocopy coupons

Concepts on crystallization from solutions which are based on general principles from the theory of phase transformations are discussed. Equations for the change in free energy during phase transformation and the work of formation of a nucleus are presented. Various theories on the nature of supersaturation and the mechanism for its formation are cited as well as crystallization of supercooled liquids. Crystallization kinetics are reviewed including rates of formation of supersaturated solutions, crystallization center formation, crystal growth, agglomeration, and recrystallization. The material balance equation and equations which relate supersaturation and the length of the induction period are given. Effects of impurities are also covered. J.M.

N71-38773 National Lending Library for Science and Technology, Boston Spa (England).
EFFECT OF SOME FACTORS ON HEAT TRANSFER IN BOILING ALKALI METALS
V. I. Subbotin et al 29 Jul. 1971 14 p Transl. into ENGLISH from the publ. "Heat Transfer in Boiling Metals in Natural Convection Conditions" Moscow, Nauka, 1969 p 104-117
(NLL-Risley-Trans-2165-(9091.9F)) Avail: Natl. Lending Library, Boston Spa, Engl.: 1 NLL photocopy coupon

The effects of heating surface material; heat transfer-surface condition and geometry; duration of heat surface contact with the metal coolant; and coolant impurity and inert gas content on heat transfer in boiling alkali metals are summarized from various experimental data. J.M.

N71-38774*# Illinois Univ., Urbana. Dept. of Physics.
HIGH-TEMPERATURE CRITICAL INDICES FOR THE CLASSICAL ANISOTROPIC HEISENBERG MODEL
David Michael Jasnow (Ph.D. Thesis) 1969 140 p refs Sponsored in part by NASA and Eastman Kodak Co.
(NASA-CR-123148) Avail: Univ. Microfilms Order No. 69-15325 CSCL 20M

The determination of the asymptotic behavior of the correlation and thermodynamic functions describing a many-body system as it approaches its critical point is discussed. Different phase transitions have striking similarities when viewed in terms of this limiting behavior. In the vicinity of the critical point, the above functions behave in a fairly simple manner. The critical indices (exponents) have been introduced to describe the various phase transitions and compare their critical behaviors. These indices measure the type and strength of the singular behavior of the associated physical quantities at the thermodynamic critical point. The exponents are defined in the terminology of magnetism. The similarity of phase transitions with qualitatively differing order parameters appears in the equality or near equality of the analogous critical exponents. Author

N71-38775 Dow Chemical Co., Midland, Mich. Thermal Research Lab.
JANAF THERMOCHEMICAL TABLES, SECOND EDITION
D. R. Stull, H. Prophet, J. Chao, A. T. Hu, E. W. Phillips et al Washington NBS Jun. 1971 1141 p Supersedes PB-168370 and addenda 1, 2 and 3
(Contracts F04611-67-C-0009; F04611-70-C-0028)
(NSRDS-NBS-37) Avail: SOD $9.75

Thermodynamic properties are presented for some 1089 chemical species. The following properties are tabulated as functions of temperatures: standard molar heat capacity at constant pressure, standard entropy, Gibbs energy function in the standard state at temperature T, enthalpy in the standard state at the temperature T less the enthalpy in the standard state at 298.15 K, standard enthalpy of formation, and log of the thermodynamic equilibrium constant of formation. Author

N71-38776 Tennessee Univ., Knoxville.
RADIATIVE EFFECTS OF HIGH ENTHALPY GAS STREAMS OVER A WEDGE
Charles Emerson Sieber (Ph.D. Thesis) 1969 130 p
Avail: Univ. Microfilms Order No. 70-17845

The radiative and convective wall heat fluxes were analyzed and compared under the following conditions:(1) wedge angle variation, (2) mach number variation, (3) wall emissivity variation. The wedge angles and Mach numbers were selected to simulate a space vehicle reentering the earth's atmosphere at superorbital velocities. A set of equations were developed which included the divergence of the radiation energy flux vector. These equations were applied to the flow region between the shock wave and the wedge surface (the hypersonic boundary layer). A nonsimilar, radiating boundary layer analysis was accomplished by an implicit finite difference formulation. Treating the hypersonic boundary layer as optically thin, the numerical solutions for both grey and nongrey radiation conditions were obtained and the differences between the computer grey and nongrey enthalpy profiles and wall heat fluxes were found to be negligible.
Dissert. Abstr.

N71-38884# Academy of Sciences (USSR), Moscow.
LABORATORY SIMULATION OF COMET PHENOMENA
Ye. A. Kaymakov and V. I. Sharkov *In its* Proc. of the 6th Ann. All-Union Winter School on Space phys., part 2 1969 p 15-20 refs In RUSSIAN (See N71-38582 24-30)
Avail: NTIS

34 GENERAL

Includes information of a broad nature related in industrial applications and technology, and to basic research; defense aspects; information retrieval; management; law and related legal matters; and legislative hearings and documents.

N71-38777*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala. Program Planning Office.
INTEGRATED MULTIPATH PROGRAM ANALYSIS AND COST TECHNIQUE (IMPACT)
O'Keefe Sullivan 15 Sep. 1971 39 p
(NASA-TM-X-64820) Avail: NTIS CSCL 05A

A technique developed to assess the impact of multiple program decisions on program cost is described and illustrated. The information presented includes a discussion of the problem of determining the effect of decisions on program cost and describes the approach to the problem solution employed by the technique described. For illustration, an application of the technique to a sample problem is included. The application includes a discussion of the sample problem, a computer program for problem solution, and the output of the program which reflects the cost of alternate solutions to the problem. A discussion of further applications and planned activities for utilization of the technique is also included. Author

N71-38778*# IIT Research Inst., Chicago, Ill.
AID/NASA PILOT PROJECT IN TECHNOLOGY TRANSFER TO A DEVELOPING NATION: KOREA Semiannual Report, 23 Dec. 1970 - 22 Jun. 1971
Gerald B. Bay 28 Sep. 1971 32 p
(Contract NASw-2083)
(NASA-CR-123183; IITRI-V6110-16) Avail: NTIS CSCL 05K

An experimental approach at providing a developing nation with an additional technological resource to aid and speed its industrial advancement is discussed. A pilot study is being conducted to determine the feasibility of the program, and to establish refined techniques for the transfer of aerospace-related technology to developing nations. The program with Korea as

the selected nation, consists of five discrete phases, including a technical mission to Korea and program scheduling, training of Korean specialists and organization of the total project and communications, and technology identification, followup, and transfer. Author

N71-38779*# Denver Research Inst., Colo. Industrial Economics Div.
PROJECT FOR THE ANALYSIS OF TECHNOLOGY TRANSFER (PATT) Annual Report, 1970
James P. Kottenstette and James E. Freeman Jul. 1971 55 p
(Contract NSR-06-004-063)
(NASA-CR-123177) Avail: NTIS CSCL 05B

Research tasks undertaken or completed during the year are described. Developments included: the implementation of technology transfer profile presentations, the formulation of a conceptual model for the technology transfer process, and an operational plan to strengthen the NASA Tech Brief program. J.G.M.

N71-38780*# George Washington Univ., Washington, D.C.
ON THE COST OF ENGINEERING EDUCATION
Guy Black Nov. 1970 159 p refs *Its* Monograph No. 7
(Grant NGL-09-010-030)
(NASA-CR-123114) Avail: NTIS CSCL 05I

The faculty necessary for an accredited engineering curriculum as a function of the number of students, faculty workload, and curriculum characteristics was determined. A minimum faculty of 32 is required, and as the student body is increased from 200 to 3200, the required faculty increases 3 3/4 times; hence there are considerable economics of scale in engineering education. The study shows how number of faculty is affected by modification of the curriculum, number of areas in which students can major, number of courses, class size or faculty workload. Faculty requirements in small autonomous engineering colleges are shown to be excessive, and with small enrollments the advantage of being part of a general university is substantial. Where engineering enrollment is large, it is possible to maintain breadth of curricula, faculty workload well within AAUP standards and moderate class size although student-faculty ratio exceeds 25:1. The research method of synthesizing a faculty from basic requirements avoids undefined variations in program characteristics that would influence survey data. The method is flexible and generally applicable to university financial and manpower planning. Author

N71-38781*# George Washington Univ., Washington, D.C.
THE CONTEXTUAL APPROACH TO TECHNOLOGY ASSESSMENT. IMPLICATIONS FOR ONE FACTOR FIX SOLUTIONS TO COMPLEX SOCIAL PROBLEMS
Louis H. Mayo Apr. 1971 92 p refs
(Grant NGL-09-010-030)
(NASA-CR-123115; GWPS-Mon-9) Avail: NTIS CSCL 05K

The one-factor fix notion (legal, economic, or technological) is examined as a means of solving existing social problems or achieving major social goals in modern, complex society. It is to demonstrate that technology assessment can assist in identifying the mix of means through time phases which will lead to more satisfactory alternative distributions of social benefits and social costs associated with public programs and projects having major technological components. It is pointed out that even where one primary means (for example, a technological application) is advanced as an adequate mode of dealing with a social problem, the contextual (total social impact) approach to assessment of such means will disclose the various non-technological facilitating arrangements required to effectively implement such means. It will also provide an evaluation of the desirability or undesirability of the effects which will flow from the implementation of such means through the supportive arrangements deemed most advisable for the particular application. Author

N71-38782*# George Washington Univ., Washington, D.C.
TECHNOLOGY ASSESSMENT AND CITIZEN ACTION
Ellis R. Mottur Mar. 1971 30 p Presented at the Profess. Seminar Ser. on Technol. Assessment, 26 May 1970
(Grant NGL-09-010-030; Contract NBS CST-463)
(NASA-CR-123116; GWPS-OP-10) Avail: NTIS CSCL 05K

A national technology assessment system is outlined, emphasizing the essential role which must be played by citizen participation. The need for citizen action in the assessment process is discussed. A major proposal is presented for the establishment of a Citizens Assessment Administration which would foster and regulate the functioning of Citizens Assessment Associations (CAA). The CAA's, which would be able to issue Citizens Assessment Bonds, would play the key role in assuring effective citizen participation in the assessment process. The legislation establishing the Citizen Assessment Administration would introduce certain innovations into the nation's legal system which would facilitate the financing and functioning of the CAA's and assure adequate consideration of their views in the assessment process. Author

N71-38783*# Techtran Corp., Glen Burnie, Md.
LAW OF THE FEDERAL REPUBLIC OF GERMANY ON EMPLOYEES' INVENTIONS OF 25 JULY 1957
Washington NASA Feb. 1971 22 p refs Transl. into ENGLISH of Sections 1, 2, and 4 of Bundesgesetzblatt Bonn, Part 1, 1957 p 757-764
(Contract NASw-2037)
(NASA-TT-F-13408) Avail: NTIS CSCL 05D

The law covers rights of employers and employees of private and public concerns and the Armed Forces to the use of the employees' inventions and suggestions for technical improvement made on the job and off the job; employers' and employees' responsibilities in that connection; and arbitrational and legal procedures for enforcing provisions of the law. Author

N71-38784# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SCIENTIFIC AND TECHNOLOGICAL FORECASTING
G. M. Dobrov 21 May 1971 241 p refs Transl. into ENGLISH of the mono. "Prognozirovanie Nauki i Tekhniki" Moscow, 1969 p 1-208
(AD-727232; FTD-MT-24-358-70) Avail: NTIS CSCL 14/2

The book is concerned with one of the most urgent problems of scientifically based planning and control of the development of science and technology - contemporary methods of analyzing and forecasting trends in scientific and technological progress. The materials for this book are the most recent developments of Soviet and foreign students of science and also on the research carried out by the scientific collective headed by the author. The book presents the original theoretical conception of scientific and technological forecasting and outlines forecasting methods of interest both for practical planning work in the field of scientific and technological development, and for the projection of complex scientific and technological objects required in advanced scientific information. Similarly, the work is one of the first books in the USSR which systematically outlines and analyzes the contemporary state of scientific and technical forecasting as a complex problem in the study of science. Author (GRA)

N71-38785# Office of Naval Research, London (England).
EUROPEAN SCIENTIFIC NOTES, VOLUME 25, NUMBER 6
Alfredo Banos, Jr. and Victoria S. Hewitson 30 Jun. 1971 41 p
(AD-727106; ESN-25-6) Avail: NTIS CSCL 14/2

The publication presents brief articles concerning recent developments in European scientific research. It is hoped that these articles (which do not constitute part of the scientific literature) may prove of value to American scientists by disclosing interesting information well in advance of the usual scientific publications. Author (GRA)

N71-38786# Naval Air Test Facility, Lakehurst, N.J.
ANALYTICAL PROCEDURE FOR DETERMINATION OF MILITARY ESSENTIALITY INDEX
Willi K. Kraut and Nicholas P. Ivanovic 16 Jul. 1971 17 p refs
(AD-727114; NATF-COS-2) Avail: NTIS CSCL 15/5

The report presents a new analytical technique for computation of a military essentiality index (MEI). This index can serve as a more definite criteria in establishing the relative worth or importance of proposed system improvements and changes. The procedure outlined involves evaluation and assignment of numerical scores to pertinent system characteristics such as system capability, subsystem effect, system availability, redundancy and alternatives. Presented is a step-by-step procedure for calculation of the index. Use of this index provides the program manager with a valuable decision making aid which can be used by him in making judgments regarding the importance and priority for incorporation of proposed equipment improvements. To illustrate the applicability of the derived procedures, an existing SATS catapult service change was evaluated and the results are presented. Procedures are applicable to other phases of the equipment life cycle including preparation of allowance lists, stockpiling, logistics, selection of subsystem or component alternates, and making decisions regarding value of redundant elements. Author (GRA)

N71-38787# Serendipity, Inc., Arlington, Va. Eastern Operations Div.
A STUDY OF THE MAGNITUDE OF TRANSPORTATION NOISE GENERATION AND POTENTIAL ABATEMENT. VOLUME 4: MOTOR VEHICLE/HIGHWAY SYSTEM NOISE
Final Report
Nov. 1970 420 p refs
(Contract DOT-OS-AS-018)
(OST-ONA-71-1-Vol-4) Avail: NTIS

A detailed analysis of motor vehicle noise generation and traffic noise prediction is presented along with a supporting analysis of noise propagation from highways. The costs of highway noise abatement are also discussed. Author

N71-38788# Department of Transportation, Washington, D.C. Office of Policy Review.
FREIGHT LOSS AND DAMAGE: AN EXPLORATORY STUDY OF ECONOMIC, ADMINISTRATIVE, AND LEGAL FACTORS AFFECTING FREIGHT LOSS AND DAMAGE
Feb. 1971 67 p refs
Avail: NTIS

Available statutes and practices were reviewed, interviews were held with leading carrier and shipper representatives, and available statistics were examined and evaluated. A special statistical analysis of one case made from original carrier reports to the ICC. The conclusions are the following: (1) Loss and damage have an apparent large but indeterminate economic significance. (2) Carriers must improve their methods of controlling and administering their affairs to prevent loss and damage. (3) Available legal remedies to the shipper and protections to the carrier are traditional: inconvenient if not cumbersome, a source of injustice to the smallshipper and tolerant of corruption by the large one. The reforms needed are better statistical and economic tools to measure the true cost, improved administrative performance of the carrier business, and innovation in the way claims are settled and responsibility is assigned. Author

N71-38789# Air Force Systems Command, Washington, D.C.
AIR FORCE RESEARCH REVIEW. NO. 2, MARCH APRIL 197
Ethel Gamer Apr. 1971 31 p refs
(AD-727338; AFSCRP-80-2) Avail: NTIS CSCL 20/12

Contents: Vortex intersections in modern aerodynamics; Methods of eliminating phased array blind spots; Signal processing with elastic surface waves; Rare earth cobalt magnets; A new vacuum microbalance; Vuilleumier cycle cryogenic coolers demonstrate a new era in aircraft reliability; Laser research; Irradiation defects and the electrical quality of ion implanted silicon; High resolution chemical ionization mass spectroscopy; Design and synthesis of materials for lasers; Geodetic application of long base interferometry; A model for evaluating the utility of forecasting natural environmental phenomena; Research advances; Research needs. GRA

N71-38790# RAND Corp., Santa Monica, Calif.
EFFECTS OF STRONG EXPLOSIONS
Simon Kassel May 1971 120 p refs
(Contract DAHC15-67-C-0141; ARPA Order 189-123)
(AD-727584; R-760-ARPA) Avail: NTIS CSCL 19/4

The report contains English-language abstracts and reviews of 1969 and 1970 articles from the open Soviet technical literature relevant to explosions, soil mechanics, laser and particle beams, thermodynamics, and reentry problems. They are grouped under the following general headings: nuclear explosions; shock waves and explosions in gases; shock waves in solids; interaction of shock waves with solids; plasma dynamics; plasma-induced surface effects; laser simulation and related effects; deformation of materials; high-pressure research; soil mechanics; particle beams; and miscellaneous, including equations of state, sound and laser wave propagation underwater, and laser beam attenuation by fog. Author (GRA)

N71-38791# Royal Aircraft Establishment, Farnborough (England).
THE USE OF DATA-PROCESSING: FROM MANAGEMENT ASSISTANCE TO AN AID IN DECISION-MAKING [L'UTILISATION DE L'INFORMATIQUE: DE L'AIDE DE LA GESTION A L'AIDE A LA DECISION]
Renaud de Rochebrune Apr. 1971 18 p Transl. into ENGLISH from Les Dossiers de l'Entreprise (France), no. 22, 1970
(RAE-Lib-Trans-1581) Avail: NTIS

The use of the computer in daily management is discussed and its potential as an aid to decision making is described. Explanations of the differences between the computer in data processing and its use in the field of management are presented. Reasons for under employment of computers as management aids are proposed. Author

N71-38792# Federal Aviation Administration, Washington, D.C. Office of Environmental Quality.
FEDERAL POLICY AND PLANNING ON THE AIRCRAFT ENVIRONMENT
John O. Powers 1 Apr. 1971 22 p
Avail: NTIS

The impact of man's activity on the environment is discussed. A short history of federal environmental legislation is presented. The activity of the FAA in environmental studies is outlined, with particular stress on the influence of aircraft and related factors. A position paper is being prepared utilizing a systematic interdisciplinary approach which integrates the use of the natural and social sciences and the environmental design arts. Author

N71-38793# Civil Aeronautics Board, Washington, D.C.
FORECAST OF SCHEDULED DOMESTIC AIR CARGO FOR THE 50 STATES, 1971 - 1976
Irving Saginor and David B. Richards Feb. 1971 30 p
Avail: NTIS

Forecasts are presented for domestic air cargo for the next five years. The forecasts are in terms of revenue ton-miles and are summations of freight (including express) and mail revenue ton-miles forecast over this period. Domestic cargo includes freight, express, and mail flown in scheduled service. These forecasts are based on a statistical analysis of historical data for the domestic operations of the carriers. The analysis indicated that the gross national product (GNP) and the levels of rates were the most important factors associated with the growth of express and freight traffic and that the GNP is the most important factor associated with mail ton-miles. The forecasts

include a projection of mail ton-miles and projections of freight plus express ton-miles. This division was necessary due to the different growth pattern exhibited by express and freight on the one hand and mail on the other. Author

N71-38794# Civil Aeronautics Board, Washington, D.C. Bureau of International Affairs.
US INTERNATIONAL AIR CARGO MARKETS, 1970
Mary Irene Pett Apr. 1971 23 p refs
Avail: NTIS

Tables covering the growth in U.S. air cargo markets in 1970 as compared to prior years and the U.S. carries participation in these markets are given. E.H.W.

N71-38795# Federal Aviation Administration, Washington, D.C. Office of Aviation Economics.
DOMESTIC AIR PASSENGER TRIP LENGTH
[1971] 24 p
Avail: NTIS

An analysis of the distances traveled by domestic air passengers is submitted which is a significant characteristic of the air commerce traffic pattern. The study is a planning tool showing the extent to which domestic air travel is short, medium, or long distance. In addition to providing a basis for estimating future passenger traffic by length of trip, the data presented indicate in broad terms the size of the national market potentially available to various passenger aircraft types such as V/STOL aircraft which are economically of technically efficient over particular stage lengths. These surveys include statistics on the number of passengers, passenger-miles, and city pairs by passenger length of trip intervals. Author

N71-38796# Joint Publications Research Service, Washington, D.C.
SOVIET-BLOC RESEARCH IN GEOPHYSICS, ASTRONOMY, AND SPACE, NO. 259
10 Sep. 1971 118 p Transl. into ENGLISH from Sino-Soviet publications
(JPRS-54029) Avail: NTIS

Abstracts are presented on the following topics: solar system astronomy, meteorological parameters and the earth's atmosphere, oceanographic research and marine economic resources, geophysical surveys (gravity, magnetic, and seismic), meteorological satellites, and upper atmosphere physics. K.P.D.

N71-38797# Joint Publications Research Service, Washington, D.C.
SCIENTIFIC AND UNSCIENTIFIC, RATIONAL AND IRRATIONAL THOUGHT
H. Klaus 6 Oct. 1971 17 p Transl. into ENGLISH from Filosofskiye Nauki (USSR), no. 4, 1971 p 141-152
(JPRS-54195) Avail: NTIS

A discussion of scientific versus nonscientific thought is presented. Philosophy as an exact science is considered in terms of dialectical materialism. K.P.D.

N71-38798# Federal Aviation Administration, Washington, D.C.
A POLICY PAPER GUIDELINES FOR NATIONAL AVIATION SYSTEM PLANNING AND R AND D POLICY Final Report
Benjamin F. L. Darden, Thomas P. Messier, and Milton B. Meisner Jun. 1971 109 p refs
(FAA-AV-71-2; FAA-AV-100) Avail: NTIS

In most long range aviation system planning, a singleness of purpose is missing. The proposed Goals Approach method of aviation system planning gives clear direction for system development. Aviation system goals should relate to broad societal needs as well as internal system requirements. Levels of research and development strongly affect rate of goal achievement. Industry and government program information indicates FAA research expenditures are appropriate at an annual expenditure rate of $100-200 million. Author

N71-38799 Virginia Polytechnic Inst., Blacksburg.
THE APPLICATION OF DISCRETE DATA MODERN CONTROL THEORY TO MICROECONOMETRIC PROBLEMS
Dale Hiett Jackson (Ph.D. Thesis) 1970 159 p
Avail: Univ. Microfilms Order No. 70-19187

The operations research science is extended by the introduction of a new modeling technique which characterizes economic systems as discrete data systems using modern control theory techniques. The concept of a state-determined economic system is introduced and established in the theoretical discussion. Numerous examples are worked to illustrate the application of the theory to systems. The theory is tested by synthesizing a discrete data model of an actual economic system and evaluating its performance. The method of synthesis and the necessary digital computer implementation of the solution are both described. As a means of comparison a model of the same system is synthesized by regression analysis. A comparison is made between the performance of the two models. A method of synthesizing an economic control strategy is proposed and a hypothetical example is included for the purpose of illustration. Also discussed are time-optimal control strategies and a control strategy modified by excitation constraints. Dissert. Abstr.

N71-37918# Fernmeldetechnisches Zentralamt, Darmstadt (West Germany).
RESULTS OF THE CCIR MEETING OF SEPTEMBER/OCTOBER 1969 WITH RESPECT TO THE APPLICATION OF SATELLITES FOR THE MARITIME AND AERONAUTICAL SERVICES
H. Werle *In* Max-Planck-Inst. fuer Aeronomie Future Appl. of Satellite Beacon Expt. Nov. 1970 5 p (See N71-37883 24-13)
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